U.S. Department of the Interior
U.S. Geological Survey

MINERALS YEARBOOK

Area Reports: International 2005

Asia and the Pacific

Volume III

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U.S. DEPARTMENT OF THE INTERIOR
DIRK KEMPTHORNE, Secretary

U.S. GEOLOGICAL SURVEY
MARK D. MYERS, Director

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Foreword

This edition of the U.S. Geological Survey (USGS) Minerals Yearbook discusses the performance of the worldwide minerals and materials industries during 2005 and provides background information to assist in interpreting that performance. Content of the individual Minerals Yearbook volumes follows:

- Volume I, Metals and Minerals, contains chapters about virtually all metallic and industrial mineral commodities important to the U.S. economy. Chapters on survey methods, summary statistics for domestic nonfuel minerals, and trends in mining and quarrying in the metals and industrial mineral industries in the United States are also included.
- Volume II, Area Reports: Domestic, contains a chapter on the mineral industry of each of the 50 States and Puerto Rico and the Administered Islands. This volume also has chapters on survey methods and summary statistics of domestic nonfuel minerals.
- Volume III, Area Reports: International, is published as four separate reports. These regional reports contain the latest available minerals data on more than 190 foreign countries and discuss the importance of minerals to the economies of these nations and the United States. Each report begins with an overview of the region's mineral industries during the year. It continues with individual country chapters that examine the mining, refining, processing, and use of minerals in each country of the region and how each country's mineral industry relates to U.S. industry. Most chapters include production tables and industry structure tables, information about Government policies and programs that affect the country's mineral industry, and an outlook section.

The USGS continually strives to improve the value of its publications to users. Constructive comments and suggestions by readers of the Minerals Yearbook are welcomed.

Mark D. Myers, Director

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Contacts

Information about the U.S. Geological Survey, its programs, staff, and products may be accessed on the World Wide Web at URL http://www.usgs.gov or by contacting the Earth Science Information Center at 1-888-ASK-USGS. For specific information about this publication, contact the Chief, International Minerals Section, Minerals Information Team, at (703) 648-7732, or the Team secretary at (703) 648-4961. Additional minerals information may be accessed on the World Wide Web at URL http://minerals.usgs.gov/minerals.

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Acknowledgments

The Country Specialists in the Minerals Information Team, U.S. Geological Survey, in preparing the International Review regional books of volume III of the Minerals Yearbook, extensively use statistics and data on mineral production, consumption, and trade provided by various foreign Government minerals and statistical agencies through various official publications. The cooperation and assistance of these organizations are gratefully acknowledged. Statistical and informational material was also obtained from reports of the U.S. Department of State, United Nations publications, and the domestic and foreign technical and trade press. Of particular assistance were reports submitted by the Resource Reporting Officers and other officers of the Department of State in U.S. Embassies worldwide. Their contributions are sincerely appreciated. Internal statistical support was provided by the staff of the Data Collection and Coordination Section of the Minerals Information Team.

The regimes of some countries reviewed in this volume may not be recognized by the U.S. Government. The information contained herein is technical and statistical in nature and is not to be construed as conflicting with or being contradictory of U.S. foreign policy.

John H. DeYoung, Jr.
Chief Scientist, Minerals Information Team

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The Mineral Industries of Asia and the Pacific

By Yolanda Fong-Sam, Chin S. Kuo, Travis Q. Lyday, Pui-Kwan Tse, David R.Wilburn, and John C. Wu

The Asia and the Pacific region, which includes 31 countries and territories, has a total area of about 29.9 million square kilometers, which accounts for about 20% of the world total. The total population was about 3.59 billion, which accounted for about 57% of the world total in 2005. China and India, which were the world's two most populous countries, accounted for 67% of the region's total population and about 38% of the world's total population. China's and Japan's economies ranked in the top five in the world. The economies of Afghanistan, China, and India were the fastest growing in the region in 2005 (tables 1, 2). Reconstruction efforts and international aid helped the Afghan economy grow.

Australia and China were among the world's leading mineral producers. Australia has large resources of bauxite, coal, cobalt, copper, diamond, gold, iron ore, lead, lithium, manganese, mineral sands, nickel, silver, tantalum, uranium, and zinc. China has large resources of antimony, arsenic, barite, coal, copper, fluorite, gold, graphite, iron ore, magnesium, mineral sands, rare earths, silver, strontium, tin, tungsten, and zinc. India also was one of the world's significant mineral producers and has large resources of barite, bauxite, chromium, iron ore, manganese, rare earths, and salt. Other significant mineral producers in the region were Indonesia, which has large resources of coal, copper, gold, nickel, and tin; Mongolia, which has large resources of copper, fluorspar, and molybdenum; Papua New Guinea, which has large resources of copper and gold; the Philippines, which has large resources of copper, gold and nickel; and Thailand, which has large resources of feldspar, gypsum, and potash.

Despite the large amount and wide variety of resources of nonfuel minerals and coal in Australia, China, India, Indonesia, Mongolia, Papua New Guinea, the Philippines, and Thailand, the regional supplies of numerous nonfuel minerals [including aluminum, bauxite, copper, diamond, gold, iron ore, lead, platinum-group metals (PGM), phosphate rock, silver, and zinc] and such major mineral fuels as coal, natural gas, crude petroleum, and refined petroleum products were insufficient to satisfy the demand in the region. The situation was caused largely by a substantial increase in consumption of nonfuel minerals and mineral fuels by China and India; by such resource-poor industrialized countries as Japan, the Republic of Korea, Singapore, and Taiwan; and by the growing economies of such middle-income developing countries as Indonesia, Malaysia, and Thailand. The Middle Eastern and North American regions supplied a large percentage of the Asia and the Pacific region's requirements for natural gas, crude petroleum, and refined petroleum products. Africa, North America, and South America supplied a substantial percentage of the region's raw material requirements for ferrous and nonferrous metals.

China and Japan were the two major regional markets for crude and processed minerals. Japan was the region's leading consumer of ferrous and nonferrous metals because of its large manufacturing sector and its poor indigenous resources. China, however, remained the region's leading consumer in terms of growth in demand, especially for such mineral commodities as aluminum, cement, coal, copper, iron and steel, lead, natural gas, crude petroleum, tin, and zinc. India, Indonesia, the Republic of Korea, Malaysia, Singapore, Taiwan, Thailand, and Vietnam also were important consumers of such mineral commodities as aluminum, cement, copper, gold, iron ore, lead, phosphate rock, silver, steel, and zinc.

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The U.S. Geological Survey (USGS) acknowledges and thanks the following foreign Government agencies, international institutions, and private research organizations for providing mineral-production statistics, basic economic data, and exploration and mineral-related information:

For mineral production statistics—

- Australia—Australian Bureau of Agricultural and Resource Economics (ABARE) and Western Australia Department of Minerals and Petroleum Resources;
- Bhutan—Ministry of Trade and Industry, Department of Geology and Mines;
- Brunei—Prime Minister's Department, Petroleum Units;
- Cambodia—Ministry of Industry, Mines and Energy, Department of Mineral Resources Development;
- India—Indian Bureau of Mines;
- Japan—Ministry of Economy, Trade and Industry, Research and Statistics Department;
- Republic of Korea—Korea Institute of Geoscience and Mineral Resources;
- Laos—Ministry of Industry and Handicraft, Department of Geology and Mines;
- Malaysia—Ministry of Primary Industry, Minerals and Geoscience Department;
- Mongolia—Mineral Resources and Petroleum Authority;
- Nepal—Ministry of Industry, Commerce and Supplies, Department of Mines and Geology;
- Sri Lanka—Geological Survey and Mines Bureau; and
- Thailand—Ministry of Industry, Department of Primary Industries and Mines.

For key economic data—

- Asian Development Bank in Manila, the Philippines;
- International Monetary Fund in Washington, DC; and
- The World Bank in Washington, DC.

For exploration and other mineral-related information—

- Australian Bureau of Statistics in Canberra, Australia; and
- Metals Economics Group in Halifax, Nova Scotia, Canada.

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General Economic Conditions

Despite the adverse effects of higher energy and mineral commodity prices, the economies of the Asia and the Pacific region remained strong. Revival of business investment was the main engine for the region's economic growth. The region's overall real gross domestic product (GDP) growth averaged about 5.4% in 2005. The growing economies of the region benefited from the robust growth in major industrial countries, especially the United States. Japan was the world's second ranked economy behind the United States; its slightly improving economy provided more investment opportunities domestically and abroad and was likely to benefit China, Indonesia, the Republic of Korea, Taiwan, and Thailand, which exported their products to Japan. Japan has been a key investor in many countries in Asia. China ranked as the region's leading economy in terms of total GDP based on purchasing power parity followed by Japan, India, the Republic of Korea, Indonesia, and Taiwan (table 2). Of the 31 countries and territories in the region, Australia ranked the richest in terms of its per capita GDP based on purchasing power parity of $30,897 followed by Japan, Singapore, Taiwan, Brunei, and New Zealand; East Timor was the poorest.

The economic growth in the Asia and the Pacific region was expected to be higher than in other regions in the world and, according to the International Monetary Fund, was projected to be about 5.3% in 2007. The economic growth of the developing countries was projected to be the fastest within the region. China's real GDP was projected to grow at a slower rate of 9% compared with 9.9% in 2005 followed by Vietnam, 7.4%, and India, 7%. China's economy was expected to continue to grow at an annual rate of about 8% until 2010. Consumption was picking up slowly but steadily, and investment was concentrated more in the energy and transportation infrastructure sectors. Japan's GDP growth was expected to be lower at 2.1% in 2007 despite a strong growth in domestic consumption. Japan's investment accounted for 30% of the total foreign direct investment made in Thailand; 25%, in the Philippines; and 16%, in the Republic of Korea.

In South Asia, the economic growth was projected to be about 6% in 2007. India's economy was projected to grow by 7%; the industry and service sectors were expected to be the main engines for this growth. The Indian Government planned to increase funding for infrastructure investment, but this increase may be constrained by large budget deficits on the part of the Federal and State Governments. Bangladesh, Pakistan, and Sri Lanka all sustained modest economic growth owing to their increased agricultural production, exports, and industrial output.

Investment Interest and Political Risk

China continued to invest heavily in expanding its mineral industry's production capacity, especially of aluminum, cement, copper, iron and steel, lead, manganese, and zinc. In 2005, investments in the coal and oil sectors increased by 65.6% and 29.7%, respectively. The Government, fearing that the sectors with strong growth were "overheated," planned to curb credit and expansion investment projects related to aluminum, cement, lead, steel, and zinc. The State Council raised the lending criteria for aluminum, cement, and steel projects by requiring that more equity investment be made via joint ventures. The Government was concerned that the new waves of investment in production capacity could diminish domestic prices because of increased supply. Yet, the rising prices of coal and iron ore in the world markets led to financial losses for many domestic ferrous and nonferrous metal producers.

In 2005, investment in Mongolia was focused mainly on copper and gold. Foreign investment increased in the areas of mineral exploration and production in the country. The mining sector accounted for 47% of total foreign direct investment. In 2005, Ivanhoe Mines Ltd. of Canada completed the feasibility study for the development of two copper-gold open pit mines at Oyu Tolgoi in Umnogovi Aimag in the southern Gobi area. The initial capital investment of about $1.2 billion would be spent for the first 5 years of the project during which 450,000 metric tons per year (t/yr) of copper concentrates and 10.2 t/yr of gold could be produced from a mine throughput of 70,000 metric tons per day.

The Indian Government continued its investment policy of allowing private sector participation in exploration and production of the mineral sector. The investment policy attracted multinational companies to participate in exploration for base metals and other minerals. During the next 5 years, domestic and foreign companies planned to invest a total of about $5 billion in a new bauxite mine, alumina refineries, aluminum smelters, and powerplants. In the iron and steel sector, investment of $30 billion was planned for greenfield steel projects and capacity expansions. The Government also abolished limits on private oil exploration, production, and marketing companies.

In Laos, Oxiana Ltd. of Australia invested $330 million and Pan Australian Resources NL of Australia invested $210 million for exploration and development of copper and gold projects. In Malaysia, an investment of $1.5 billion was to be spent for the first phase of the Sarawah aluminum smelter project by Smelter Asia Sdn. Bhd. Cahya Mata Sarawak Bhd. and China's Sinohydro Corp. and Shandong Luneng Group signed a memorandum of understanding to jointly build an aluminum smelter in Sarawak with a total investment of $3 billion. In Thailand, Sougan Corp. of China planned to invest about $2.5 billion to build an integrated steel plant to supply a wide range of steel products to the Thai domestic market and for export to the Association of Southeast Asian Nations (ASEAN) countries. In Vietnam, Aluminum Corp. of China and Vietnam National Coal Corp. planned to jointly develop a bauxite mine and an alumina refinery in Dak Nong Province with an investment of $2 billion.

Legislation

China's mineral resources law was enacted in 1986 and amended in 1996. To attract foreign investment in mineral development and production in China, the Government urged the National People's Congress to amend the law to redefine mineral rights. In 2000, the State Council issued a decree to allow foreign investors to establish wholly owned mining subsidiaries to explore, develop, and produce minerals in China. In 2003, the Ministry of Land and Resources

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established a mineral resources law consultant committee to seek recommendations from domestic and overseas mining law experts. In 2005, a multinational mining consortium that included BHP Billiton plc and Rio Tinto Group began working with the Government to revise the country's mineral resources law for foreign investors. The Government also established an energy law leadership group composed of representatives from 15 Government agencies to draft a new energy law. The proposed new law would close legislative gaps among existing regulations and laws and stress energy efficiency and sustainability and environmental protection. The group planned to complete a draft of the new law in the next 2 years.

The Indian Government decided that foreign equity holding was allowed up to 100% automatically for all nonfuel minerals, including diamond and precious stones. Coal, oil and gas, and uranium were exempted. The Government also introduced a Federal value-added tax (VAT) in April 2005 that replaced a complex web of Indian State sales taxes. The VAT formed the centerpiece of the Government's tax measures to simplify the system and raised revenue for cash-strapped regions. Eight States opposed the tax but a majority of India's 29 States had adopted the tax by yearend 2005.

In Indonesia, the drafting of a proposed new mining law (the Mineral and Coal Mining Law) was completed by the Ministry of Energy and Resources and submitted to the State Secretariat for approval before submission to the House of Representatives to be legislated into law. As of 2005, the legislative process had been ongoing for more than 4 years. The new mining law would replace General Mining Law No. 11/1967. The replacement was considered to be necessary because the old law was not compatible with conditions in the mining sector.

Mongolia's mineral law was adopted in 1997 and amended in 2001. A proposed bill relating to tax incentives for mining companies would reduce the 100% tax exemption to the first 2 years followed by a 50% exemption for the next 3 years. The duration of exploration licenses would be changed to 2 years with a discretionary extension of 3 years and the option of a 2-year extension. The drafted bill also proposed to change the term of mineral resource licenses to 20 years with the possibility of two 10-year extensions for a total of 40 years instead of the current terms of 60 years with a possible extension of 40 years for a total of 100 years. The proposed amendments on the mineral law were submitted to the Parliament for approval in December 2005 and were expected to be enacted in 2006.

In New Zealand, the Crown Minerals Act of 1991 sets the broad legislative policy for prospecting, exploration, and mining of Government-owned minerals in the country. In 2004, the Crown Minerals Business Plan outlined two strategic priorities for the Ministry of Economic Development to improve the security of the energy supply and to promote regional economic development. In Thailand, the Minerals Act of 1967, which stipulates the ownership of mineral resources by the state, was last amended in 2002 for underground mining; the Act permits mining at depths of greater than 100 meters below the surface without the need to obtain the specific consent of the holder of the surface right.

Several developments that took place during 2004 and 2005 affected the investment climate for mineral exploration in the Philippines. In January 2004, Executive Order No. 270 (the National Policy Agenda on Revitalizing Mining in the Philippines) was issued. The order contained 12 guidelines for responsible mining while adhering to sustainable development. It contained a Minerals Action Plan crafted jointly by the private sector and Government stakeholders. Another landmark was the decision by the Philippine Supreme Court that provisions of the Philippine Mining Act of 1995 allowing certain financial or technical assistance agreements with foreign corporations were legal (Sitathan, 2005).

Exploration

Exploration activity in much of the Asia and the Pacific region increased in 2005 from the 2004 levels. Data derived from the Metals Economics Group (MEG) suggest that the 2005 proposed budget allocations for Australian exploration activity increased by 18% to $616 million from $522 million in 2004. Similarly, the 2005 budget for the Pacific region countries (excluding Australia) increased by 35% to $210 million in 2005 from $156 million in 2004 (Metals Economics Group, 2005§[1]). The estimate for the exploration budget for mainland Asia also increased in 2005, primarily for China ($130 million) and Mongolia ($123 million) from the $186 million (combined) reported in 2004 for these two countries (Cox and Goulden, 2005§).

Although the MEG estimates of Australian mineral exploration budgets increased in 2005 from the 2004 level, Australian activity has generally declined since 1999 in terms of Australia's share of the worldwide exploration budget. The MEG estimate for the 2005 Australian exploration budget allocation declined to 12.6% of the total world exploration budget in 2005 from a high of 18.7% in 1999. The Australian Bureau of Agricultural and Resource Economics (ABARE) reported minerals exploration expenditures for the fiscal year 2004-05 to be $664 million, as compiled by the Australian Bureau of Statistics (Australian Bureau of Agricultural and Resource Economics, 2005a§). Western Australia accounted for about 59% of Australian mineral exploration expenditures (Flint, 2006, p. 1). The ABARE report showed exploration for metals and other minerals was up by about 27% from 2003-04. ABARE reported that 2004-05 gold exploration accounted for 45% of the total reported Australian expenditure for metals and other minerals (down from the 57% it represented in 2003-04), nickel and cobalt exploration accounted for about 18%, iron ore exploration accounted for 16%, and copper exploration accounted for 8%. Other minerals and metals with increased expenditures in 2004-05 compared with 2003-04 levels were base metals, heavy mineral sands, and iron ore. Exploration for iron ore was in part driven by Chinese demand for the metal.

Of the 241 active mineral exploration projects considered by ABARE in 2005, 74 (31%) were new exploration projects and 84 (35%) were advanced (committed for construction) projects (Australian Bureau of Agricultural and Resource Economics, 2005b§). Of the estimated $10.8 billion being invested in

[1]References that include a section mark (§) are found in the Internet References Cited section.

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advanced projects (excluding energy projects), about $4.3 billion was being spent on iron ore; about $2.0 billion, on alumina; and about $1.4 billion, on nickel projects. Based on USGS site data, early stage projects accounted for about 76% of the 2005 activity and feasibility stage projects accounted for about 11%.

The Australian States and Territories that experienced the highest level of exploration activity in 2005 were, in descending order based on the number of sites, Western Australia (56%), Queensland (14%), New South Wales (9%), South Australia (8%), Northern Territory (7%), and Tasmania (4%). Many of the noteworthy projects were in the advanced evaluation or development stage. Western Australia continued to account for the majority of exploration dollars spent in Australia for many commodities. In 2005, this State accounted for about 99% of the iron ore exploration expenditures, about 94% of nickel-cobalt, about 67% of diamond, 66% of gold, and 54% of heavy-minerals expenditures (Flint, 2006, p. 3).

The Queensland government announced a plan to spend $15 million to conduct minerals mapping programs in the Bowen and the Surat Basins, the Drummond Basin, the Mount Isa region, and the Mount Rawdon corridor (MineBox, 2005a§). The South Australian government has allocated $1.5 million in grants to 35 resource exploration projects through its Plan for Accelerating Exploration (PACE) initiative begun in 2004 (MineBox, 2005b§).

Native title claims issues continue to affect Australian exploration and mining. In 2005, 92 native title claims applications were processed in Australia (National Native Title Tribunal, 2005§). Reforms were announced during 2005 by the Australian Government to improve the performance of the native title system (Australian Attorney General's Department, 2005§).

Based on MEG data, the 2005 exploration budget allocation for the Pacific region and Southeast Asia was about $210 million, up in dollar terms from the 2004 level of $156 million, and down slightly to 4.3% of the world exploration budget from the 4.4% reported for 2004. Countries with the most activity in 2005 in terms of their exploration budget included Indonesia (29%), Papua New Guinea (23%), and the Philippines (20%) (Cox and Goulden, 2005§). Countries with the most activity in terms of exploration sites included Papua New Guinea (25%), Indonesia (23%), and the Philippines (17%). According to USGS site information, a significant portion of the interest was focused on later-stage projects, which accounted for about 41% of all exploration. Gold targets accounted for about 71% of all exploration interest in the Pacific region; copper, about 13%; and nickel, about 7% of the reported activity in 2005. Significant project activity included expansion of copper-gold reserves in the Grasberg area (Indonesia), drilling for deposit extensions at Penjom (Malaysia) and Chatree North (Thailand), and feasibility drilling at Simberi (Papua New Guinea).

Exploration activity within mainland Asia focused on China and Mongolia in 2005. MEG estimates suggest that about $130 million was budgeted for Chinese exploration in 2005, up by 51% from the $86 million budgeted in 2004. Similarly, MEG estimated that the 2005 mineral exploration budget in Mongolia was about $123 million, or 23% higher than the 2004 budget of about $100 million (Cox and Goulden, 2005§).

Mineral exploration in China has increased since the country opened its mining sector to foreign investment. In 2005, 83 foreign companies invested $130 million in mineral exploration in China; in 2002, only 7 foreign companies invested about $10 million in Chinese mineral exploration. Forty-five companies based in Canada, 14 based in Australia, and 7 based in the United States were exploring in China. Based on MEG estimates of spending allocations, approximately 70% of this exploration was for gold, 20% for base metals, and 10% for diamond and other minerals (Cox and Goulden, 2005§).

Chinese mining reforms continued to strengthen the country's mining and exploration sector. The large increase in demand for minerals by its industries resulted in increased domestic minerals exploration activity and a larger number of foreign mineral exploration agreements. Income from the exploration and mining license auctions in Inner Mongolia in 2005 was estimated to be $60.5 million compared with $45 million in 2004 (China Mining and Mineral Commodities Newsletter, 2005a). The China Finance Ministry reportedly will invest about $4.8 million each year for the next 5 years on exploration in the Xinjiang Autonomous Region and will invest an additional $30 million for geologic mapping (China Mining and Mineral Commodities Newsletter, 2005b). In addition, Chinese investors have signed mineral exploration agreements with foreign countries and companies to provide China with a long-term supply of minerals from abroad. Examples include agreements in Western Australia for areas rich in iron ore and heavy minerals and ones in Burma (Myanmar) for base and precious metals exploration (International Mining, 2005).

Interest in mineral exploration in Mongolia in 2005 was in large part driven by the proposed amendments to the minerals legislation of 1997 and exploration and development activity of Ivanhoe Mines Limited at its Turquoise Hill (Oyu Tolgai) copper-gold project. Exploration activity in the minerals sector increased by 43% since 2000, and, in the first half of 2005, it increased by 10.7% from the corresponding period in 2004 (Batbileg, 2005).

Commodity Overview

Estimates for production of major mineral commodities for 2007 and beyond have been based upon supply-side assumptions, such as announced plans for increased production/new capacity construction and bankable feasibility studies. The outlook tables in this summary chapter show historic and projected production trends; therefore, no indication is made about whether the data are estimated or reported and revisions are not identified. Data on individual mineral commodities in tables in the individual country chapters are labeled to indicate estimates and revisions. The outlook segments of the mineral commodity tables are based on projected trends that could affect 2005 producing facilities and on planned new facilities that operating companies, consortia, or Governments have projected to come online within indicated timeframes. Forward-looking information, which includes exploration and mine development, estimates of future production, cost of capital projects, and timing of the start of operations, are subject to a variety of risks and uncertainties that could cause actual events or results to

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differ significantly from expected outcomes. Projects listed in the following section are presented as an indication of industry plans and are not a USGS prediction of what will take place.

Metals

Aluminum and Bauxite and Alumina.—The region's production of bauxite accounted for about 53% of the world total in 2005. Australia, which was the world's leading producer of bauxite, accounted for 35% of the world total; it was followed by China, 10%, and India, 7%. Production of aluminum accounted for about 34% of the world total in 2005. China, which was the world's leading producer of aluminum, accounted for about 21% of the world total; it was followed by Australia, 5%; Japan, 3%; and India, 2% (table 4).

Regional production of bauxite and primary aluminum was expected to continue to grow at an average annual rate of about 3% and 6%, respectively, between 2005 and 2011 (tables 5, 6). This prediction was based on reported capacity expansions in Australia, China, India, New Zealand, and Vietnam. Regional production of secondary aluminum was expected to increase to 1.6 million metric tons (Mt) in 2011 with a slight decrease in estimated production in Japan and a substantial increase in estimated production in China (table 7).

In Australia, alumina capacity expansions included the construction of a 1.4-million-metric-ton-per-year (Mt/yr) refinery by Comalco Ltd. at Gladstone, Queensland, which was completed in 2005; a 600,000-metric-ton-per year (t/yr) refinery at Pinjarra; and a 250,000-t/yr refinery at Worsley. The latter two were scheduled to be completed in 2006. A new aluminum smelter with a capacity of 18,000 t/yr would be brought onstream by Hydro Aluminum Ltd. in 2006. In China, several companies either began or planned construction of alumina refineries in the Provinces of Guangxi, Henan, Shandong, and Shanxi. Projected bauxite production was based on the estimated alumina output less the estimated bauxite imports in years 2007-11. Estimated aluminum production was based on the China Development Plan for 11 smelter projects under construction with a total combined capacity of 1.12 Mt/yr and 10 projects undergoing feasibility study with a total combined capacity of 1.4 Mt/yr. In the State of Orissa in India, Dubai Aluminium Co. and Larsen & Toubro Ltd. planned to build a bauxite mine and a 1.4-Mt/yr alumina refinery, which was expected to be commissioned in 2009. Vedanta Resources plc started construction of a 1.4-Mt/yr alumina refinery, which was scheduled to be completed in 2007; the company was also considering building an aluminum smelter in Orissa with a first-phase capacity of 250,000 t/yr in 2009 and a second-phase capacity of 250,000 t/yr in 2010. JSW Group planned to build a 250,000-t/yr aluminum smelter at Visakhpatnam in the state of Andhra Pradesh. In Vietnam, Vietnam National Minerals Corp. planned to develop a 1.7-Mt/yr bauxite mine in Lam Dong Province by 2010; the feasibility study was approved by the Government in 2005.

Copper.—The region's production of mined copper accounted for about 21% of the world total in 2005. Indonesia was the leading regional producer followed by Australia and China. Production of primary refined copper accounted for about 35% of the world's total output in 2005. Among the region's refined copper producers, China was the world's second ranked producer of primary and secondary refined copper, and Japan was ranked third. Australia, India, and the Republic of Korea also were important producers of refined copper in the region (table 4).

Between 2005 and 2011, regional production of mined copper and of refined copper were each expected to continue to increase at an average annual rate of about 5%. This prediction was based on reported capacity expansions of mined copper in Australia, Burma, Indonesia, Laos, Mongolia, Thailand, and Vietnam, and on reported capacity expansions of refined copper in China, Burma, Japan, and Thailand (tables 8, 9).

In Australia, mine production was expected to increase because of higher output from the Tritton copper mine, which was owned by Tritton Resources, and Telfer gold/copper mine, which was owned by Newcrest Mining Ltd. Several copper mine projects were expected to start up in 2007. BHP Billiton was considering an expansion of its Olympic Dam Mine to 500,000 t/yr and Oxiana Ltd.'s Prominent Hill copper and gold project was under bankable feasibility study. Production of refined copper was expected to increase to 500,000 t/yr in 2007 and to 800,000 t/yr in 2011 owing to a 20,000-t/yr expansion project by MIM Holdings Ltd. and the 15,000-t/yr Lady Annie greenfield project. In Indonesia, gradual capacity expansions were to be undertaken by P.T. Freeport Indonesia Co. at Grasberg, Province of Papua, and by P.T. Newmont Nusa Tenggara at Batu Hijau on Sunbawa Island, Province of West Nusa Tenggara. In China, Yulong copper mine in Xizang was expected to be brought onstream in 2009. For refined copper, Jiangxi Copper Co. Ltd. planned to increase its refining capacity to 700,000 t/yr in 2010 from 400,000 t/yr in 2005 at Guixi, Province of Jiangxi, and Yunnan Copper Group Co. Ltd. planned to increase its refinery capacity to 600,000 t/yr in 2010 from 350,000 t/yr in 2005 at Kunming, Province of Yunnan. A greenfield copper refinery in Shandong was expected to produce 400,000 t/yr in 2010. In India, Pebble Creek Resources Ltd. planned to build a 210,000-t/yr (ore) underground copper mine at Pithoragarh, State of Uttaranchal, which was expected to begin production in 2007.

In Japan, Sumitomo Metal Mining Co. Ltd. planned to gradually expand the capacity of its Toyo Smelter and Refinery to 450,000 t/yr by 2008. Capacity utilization was expected to increase as a result of more feedstock from Japanese direct equity investment in major copper mining projects abroad. In Burma, Monywa JV Co. began its expansion program to increase its capacity to 50,000 t/yr of copper cathodes in 2005 and to 125,000 t/yr in 2009. In Laos, Oxiana Ltd. of Australia completed a copper processing plant at the Khanong deposit to produce 60,000 t/yr of copper cathodes in 2006 and planned to expand plant operation to 90,000 t/yr following the discovery of additional reserves. Pan Australian Resources NL of Australia planned a 9-Mt/yr flotation plant for the Phu Kham copper-gold project to produce 50,000 t/yr of copper in 2008. In Thailand, Pan Australian Resources, in joint venture with Padaeng Industry Public Co. of Thailand, planned to develop a copper mine and to build a processing plant at their PUT 1 deposit, which could begin operations with a capacity of 30,000 t/yr of copper cathodes by 2008. Thai Copper Industries plc's 165,000-t/yr copper smelter and refinery in Rayong was expected to reach near-full capacity in

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2007 or 2008. In Vietnam, Vietnam Coal and Mineral Industries Group completed construction work on a copper mine and smelter at Sin Queyen, Province of Lao Cai, to produce 42,000 t/yr of copper concentrate and 10,500 t/yr of refined copper in 2006.

Japan was one of the world's major import markets for copper concentrates and refined copper. The country imported 4.3 Mt of copper concentrates and 74,000 metric tons (t) of refined copper in 2005. China also was a significant importer of copper concentrates and refined copper. China imported about 4 Mt of copper concentrates and about 1.2 Mt of refined copper. Other important consumers of copper concentrates in the region were India and the Republic of Korea, which imported about 800,000 t and 1.4 Mt, respectively. Australia, Indonesia, Mongolia, and Papua New Guinea were the major regional suppliers of copper concentrates to China, Japan, and the Republic of Korea. Japan, the Republic of Korea, and the Philippines were the region's major suppliers of refined copper to China and other Southeast Asian countries.

Gold.—The region's production of mined gold accounted for about 32% of the world total in 2005. Australia was the leading mined-gold-producing country in the region, followed by China and Indonesia (table 10). Australia was ranked second after the Republic of Africa in the world production of gold. Papua New Guinea also was a significant gold producer in the region.

Australian gold production was expected to grow only steadily in the next few years. A number of operations, including Ballarat Goldfields' Ballarat East Mine in Victoria and BMA Gold's Twin Hills Mine in Queensland, began operation in 2005. The Bendigo Mine in Victoria, the Fortnum Mine in Western Australia, the Gully and the Union Reef Mines in Northern Territory, and the Warrior Mine in Queensland all were expected to be brought onstream in 2007. In 2005, China's production of mined gold reached a record high of 225 t. The Lannigou Mine in Guizhou was expected to start production in 2008. Gold production in Indonesia increased because of access to exceptionally high-grade ore from Freeport's Grasberg Mine, and output was expected to remain steady in the next several years. Owing to development of the Boroo Mine, Mongolia's production of mined gold increased sharply. Laos increased its mined gold operation at the Sepon gold mine by Oxiana Ltd. and at the Phu Bia heap-leach gold mine by Pan Australian Resources.

Regional production of mined gold was expected to continue to increase at an average annual rate of 5% between 2005 and 2011. This prediction was based on gradual capacity expansions mainly at the major copper and gold mines in Australia, China, Indonesia, and Mongolia. Production of mined gold in Burma, Fiji, Japan, Laos, and North Korea was expected to hold steady from 2007 to 2011 (table 10).

The region was the world's major market for gold. India was the world's leading consumer of gold. In China, continuous strong economic growth and rising urban incomes were expected to lead to higher demand for gold jewelry in the next few years. Gold demand in other countries in the region was expected to remain steady in the future.

Iron and Steel.—The region's production of iron ore was estimated to account for, in terms of gross weight, about 54% of the world total in 2005. Australia ranked second in the world as a producer of iron ore; it was followed by China and India. The region's production of crude steel was estimated to account for about 52% of the world total. China, which was by far the world's leading producer of crude steel, accounted for about 31% of the world total. Its crude steel output was more than the combined total production of Japan, the United States, and Russia, which ranked second, third, and fourth, respectively (table 4).

East Asian countries, such as China, Japan, and the Republic of Korea, were the world's leading consumers and importers of iron ore. Australia was the region's and the world's leading supplier of iron ore. India's iron ore output increased sharply to meet domestic and regional demand. India replaced Brazil as China's second ranked iron ore supplier after Australia and was expected to remain in that position for the next several years. Brazil and South Africa also would continue to be major iron ore suppliers to the region. Imports of iron ore by East Asian countries were expected to continue to increase, especially by China to meet its steel industry's demand.

Regional production of iron ore was expected to increase at an average annual rate of about 3% between 2005 and 2011. This prediction was based on gradual capacity expansions in Australia, China, and India. Capacity expansion in Australia was planned at Rio Tinto plc's Yandicoogina Mine to 52 Mt/yr in late 2007. Rio Tinto also planned to develop a 22-Mt/yr iron ore mine at Hope Downs in Western Australia by 2008. BHP Billiton planed to expand capacity at its Newman Mine to 63 Mt/yr in 2010. Several smaller mines, such as the Jack Hill, the Koolan Island, and the Middleback Range, were expected to come onstream in 2007. In India, a large new iron ore mine at Gandhamardan Malanjtoli, State of Orissa, was scheduled to start production in 2006 (table 11).

China was the world's leading consumer of steel products. Japan was the world's leading exporter and the region's major supplier of steel products to China and to such major consumers in the region as the Republic of Korea, Singapore, Taiwan, and Thailand. Owing to the low steel consumption in the region, the ASEAN countries continued to be small steel producers.

Regional production of crude steel was expected to increase at an average annual rate of about 5% between 2005 and 2011. China was expected to lead in crude steel expansion in the region. Shoudu Iron and Steel Group Co. and Tangshan Iron and Steel Group planned to build a 10-Mt/yr greenfield steel plant in Hebei Province. Anben Iron and Steel Group planned to expand steel capacity in Liaoning Province to 30 Mt/yr by 2010. The first-phase 5-Mt/yr capacity of Angang's 10-Mt/yr Greenfield steel plant in Liaoning Province was scheduled to be brought onstream in 2006. Tonghua Iron and Steel Group Co. Ltd. planned to expand capacity in Jilin Province to 10 Mt/yr during the next 3 to 10 years.

India also was expected to expand its crude steel capacity significantly. The expansion would include the construction of a 13-Mt/yr steel plant at Paradip, State of Orissa, as proposed by the government of Orissa and Pohang Iron and Steel Co. Ltd. of the Republic of Korea, which was expected to start producing steel in 2009. It would also include the capacity expansion projects by JSW Steel Co. Ltd. at Vijayanagar, State of Karnataka, which were expected to increase capacity to

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7 Mt/yr in 2008 and 10 Mt/yr in 2011. Tata Steel planned to expand its Jamshedpur steel plant's capacity to 36.5 Mt/yr. In Vietnam, Thai Nguyen Iron and Steel Co. planned to increase steel capacity to 1 Mt/yr by 2008 and to 1.3 Mt/yr by 2010 (table 12).

Lead and Zinc.—The region's production of mined lead and zinc accounted for about 55% and 44%, respectively, of the world total in 2005 (table 4). China ranked as the world's leading producer of mined lead and zinc and accounted for about 30% and 26%, respectively, of the world total in 2005; it was followed by Australia, which accounted for more than 23% and 14%, respectively. India and North Korea were the region's other important producers of mined lead and zinc; their production levels slightly increased in 2005. China was the world's leading producer of lead and zinc metal, and Australia, India, Japan, and the Republic of Korea were the region's other important producers of lead and zinc (table 4).

China was the world's second ranked consumer of primary and secondary lead after the United States in 2005. The substantial growth in demand for lead during the past several years was owing to the continuing increase in demand for storage batteries by the growing number of automobile producers in China. In its coastal provinces, substantial increase in battery recycling capacity also led to more supply of secondary lead in 2005. Japan and the Republic of Korea were the region's other important consumers of primary and secondary lead and primary slab zinc; their demands for lead and zinc remained relatively steady during the past several years.

Regional production of mined lead and zinc was expected to increase at an average annual rate of about 2% and 5%, respectively, between 2005 and 2011. This prediction was based on reported capacity expansions in Australia, China, and India (tables 13, 19). Regional production of primary refined lead and zinc metal was expected to increase at an average annual rate of about 2% and 4%, respectively, between 2005 and 2011. This prediction was based on gradual capacity expansions mainly in Australia and China. Regional production of secondary refined lead was expected to decrease in 2007 and to increase thereafter because China's battery recycling capacity was not fully used (tables 14, 15, 20).

In Australia, gradual capacity expansions were expected to be carried out at the Cannington Mine in Queensland by BHP Minerals Ltd. and at the George Fisher and the Hilton Mines in Queensland by MIM. Teck Cominco Corp. planned to reopen its Lennard Shelf Mine in 2007, and the Black Star zinc mine in Queensland was expected to begin operation in 2006. Several smaller zinc mines were planned and could produce 1.9 Mt/yr of zinc concentrate by 2011. In India, Hindustan Zinc Co. Ltd. completed its zinc refining expansion at Chanderiya, State of Rajasthan by 170,000 t/yr to 402,000 t/yr and planned a second expansion of 170,000 t/yr to increase capacity to 572,000 t/yr. The Rampura Agucha lead and zinc mine was expanded to an output of 3.75 Mt/yr in 2005.

In China, reported capacity expansions were for the new Bairendaba Mine in the Nei Mongol Autonomous Region to be brought onstream and to produce 10,000 t/yr of lead in concentrate. Aerhada Mining Co. Ltd. and Bayannur Zijin Nonferrous Metal Co. Ltd. started construction of a 100,000-t/yr zinc smelter in Dong Ujinqin and Urad Houqi, respectively, in the Nei Mongol Autonomous Region in 2005, and both were expected to begin production in 2006. In Japan, Toyoha Mining Co. Ltd. planned to close its lead-zinc-silver mine in Hokkaido Prefecture in 2006 because of depletion of ores, but the closure would not affect the increasing regional production of mined zinc.

Nickel.—The region's production of mined nickel, in terms of metal content, accounted for about 37% of the world total in 2005. Australia was the world's second ranked producer of mined nickel after Russia in 2005. Indonesia and New Caledonia, which were the region's other major producers of mined nickel, accounted for 11% and 7%, respectively, of the world total (table 4).

Japan was the world's leading consumer and importer of nickel ore and nickel matte; more than 4.5 Mt/yr of nickel ore (gross weight) was imported from Indonesia, New Caledonia, and the Philippines for the production of ferronickel. Japan imported more than 100,000 t/yr of nickel matte from Australia and Indonesia for the production of refined nickel metal and chemicals. The country was the world's second ranked producer after Russia of primary nickel, which included chemicals, ferronickel, nickel oxide sinter, and pure nickel metal. China also was a key regional consumer and importer of nickel ore, matte, and pure metal.

Regional production of mined nickel was expected to continue to increase at an average annual rate of more than 6% between 2005 and 2011. This prediction was based on reported gradual expansions of capacity and increases in productivity (table 16). In Australia, BHP Billiton's Ravensthorpe Mine was scheduled to begin operation in mid-2007 and to produce up to 50,000 t/yr of nickel. Refinery expansion at Yabulu in Townsville was expected to be completed in 2007 and to reach 180,000 t/yr in 2010. In China, gradual capacity expansions were to be undertaken at mines in the Xinjiang Autonomous Region during the period 2005-11. A nickel mine in Yuanjiang County, Province of Yunnan was to be developed, and a 10,000-t/yr nickel refinery nearby was to be built by 2008. In New Caledonia, Inco Limited of Canada was to begin construction of a new large-scale mining and hydrometallurgical nickel-cobalt extraction complex at Goro in 2007; its feasibility study was completed in 2005, but the Goro project could be delayed because of social and environmental concerns.

Stainless steel production accounted for about 65% of total world nickel consumption, and the demand for nickel was linked to the consumption of stainless steel. In the past several years, the demand for stainless steel in the region increased significantly, especially in China. China was a major stainless steel importing country and Japan, the Republic of Korea, and Taiwan supplied about 90% of China's total imports. China's stainless steel output from Baogang and Taiyuan Iron and Steel Co. increased gradually and was expected to grow strongly as several new mills were to begin operation. Nickel consumption in China was expected to increase substantially in the next several years and the nickel consumption in such other countries as Japan, the Republic of Korea, and Taiwan was expected to decline in the future and would likely offset the increasing demand in China.

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Platinum-Group Metals.—The region's production of mined platinum and palladium was insignificant and accounted for only 0.4% and 0.6%, respectively, of the world total in 2005 (tables 17, 18). Jinchuan Nonferrous Metals of China produced platinum and palladium as byproducts of mined nickel from its nickel mining and refining operations at Jinchuan, Province of Gansu. Australia was not a primary producer of platinum-group metals (PGM), although small amounts of palladium were produced as a byproduct of nickel operations at Kalgoorlie-Boulder and Kambalda in Western Australia.

Regional production of mined platinum was expected to increase at an average annual rate of 7% between 2005 and 2011. This prediction was based on gradual capacity expansion of mined nickel in China (table 17). Regional production of mined palladium was expected to increase at an average annual rate of 5% between 2004 and 2011. This prediction was based on gradual capacity expansion of mined nickel in Australia and China (table 18). Regional PGM consumption was expected to increase in autocatalysts and electronics. The rapid growth in the manufacture of automobiles, light vehicles, computers, and electronic goods in China and India raised the demand for PGM in the region.

Industrial Minerals

Diamond.—The region's production of diamond accounted for more than one-quarter of the world total in 2005. In Australia, diamond was produced mainly from the western Kimberley region of Western Australia. The Argyle Mine, which is located in the Ellendale diamond province in Western Australia, was Australia's largest and the world's leading producing diamond mine. Diamond produced from the Argyle Mine by Rio Tinto Ltd. accounted for about 20% of the world total in 2005. Another diamond mine operated by Rio Tinto was the Merlin Mine in the Northern Trough in the Northern Territory of Australia.

Regional production of diamond was expected to stay in a narrow range of between 28 million and 31 million carats per year after reaching a peak level of 55 million carats in 2005 in which Australia contributed most of the output. Australia's production of diamond, however, was expected to decline sharply in 2007. At Argyle, the underground mining operation would account for 60% of its total output in 2008, and the open pit operation would gradually be shut down (table 21).

Phosphate Rock.—The region's production of phosphate rock, in terms of phosphorus pentoxide (P_2O_5) content, accounted for about 20% of the world total in 2005. China was the world's second ranked producer of phosphate rock after the United States; it was followed by Morocco and Russia. Other important producers in the region were Australia, India, and Vietnam. Most of the region's production of phosphate rock was consumed within the region. China was the world's leading consumer of phosphate rock, and its demand for phosphate rock was expected to increase substantially in the next 5 years.

Regional phosphate rock production was expected to increase at an average annual rate of about 1%, which would lead to a shortage in the regional supply because the regional demand for phosphate rock was expected to grow at a much higher rate than 1% per year during the next 5 to 6 years. By 2010, China's domestic supply of phosphate rock was expected to be insufficient to meet its demand. The country was projected to produce 12 Mt (in P_2O_5 content) of phosphate fertilizer and to consume 46.5 Mt of phosphate rock in 2010, and would be required to import an additional 8 Mt of phosphate rock to meet its needs (table 22).

Mineral Fuels

Coal.—The region's overall production of coal, which included anthracite, bituminous, and lignite, accounted for more than 50% of the world total in 2005. Production of anthracite coal, however, accounted for about 89% of the world total; production of bituminous coal accounted for about 59%; and production of lignite accounted for about 20%. China, which was by far the world's leading producer of anthracite and bituminous coals, accounted for about 74% and 41%, respectively, of the world total. In the Asia and the Pacific region, North Korea and Vietnam were the other significant producers of anthracite coal; Australia, India, and Indonesia were the other important producers of bituminous coal and lignite (table 4). Japan was the world's leading importer and consumer of coal; virtually all coal requirements for its iron and steel and utility industries were imported. Australia ranked as the world's leading coal exporter. The major regional coal exporters (suppliers) were Australia, China, and Indonesia.

Overall regional coal production was expected to increase at an average annual rate of about 4% between 2005 and 2011. This prediction was based on planned capacity expansions and newly developed mines. In Australia, the Rollestone coal mine in Queensland was completed in 2005 and was expected to produce 6 Mt/yr in 2006 and 12 Mt/yr in later years following completion of the second phase of development. Capacity expansions of the Dawson, the Ensham, the Grasstree, and the Hail Creek Mines in Queensland were expected to be completed in 2007. In India, Coal India Ltd. planned to expand capacities to 364 Mt/yr in 2006 and to 504 Mt/yr in 2011 (table 23).

Uranium.—The region's uranium resources were located mainly in Australia, which ranked first in known recoverable resources of uranium in the world and accounted for 24% of the world total. The country ranked second after Canada in the production of mined uranium in terms of uranium oxide (U_3O_8) content. In Australia, three active mines were operated, namely, the Beverly, the Olympic Dam, and the Ranger Mines, and two more were under development. In 2005, The Ranger Mine was the leading producer in Australia. A number of undeveloped deposits were located in Northern Territory, Queensland, South Australia, and Western Australia. BHP Billiton planned to expand Olympic Dam's uranium output to 15,000 t/yr from 4,400 t/yr in 2005. China was thought to produce about 1,200 t/yr of mined uranium in 2005, and production was expected to increase gradually to 1,500 t/yr by 2011. Most mined uranium was enriched and consumed domestically in China. China planned to add 10 more nuclear powerplants in the coastal area during the next 10 years to relieve the electricity shortage in the area. China's uranium consumption was expected to increase and the country was interested in investing in uranium mines in Australia.

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Australia exported nearly all its mined uranium in concentrate of U_3O_8 to China, Japan, and the Republic of Korea within the region and elsewhere to France, Spain, Sweden, the United Kingdom, and the United States.

Regional production of mined uranium was expected to increase at an average annual rate of about 0.5% between 2005 and 2011. This prediction was based mainly on capacity expansions at the Olympic Dam Mine by WMC Resources Ltd. and two in situ leach operations to produce U_3O_8 at the Beverly Mine by Heathgate Resources Pty. Ltd. and at the Honeymoon Mine by Southern Cross Resources Inc. in South Australia. The Honeymoon project was approved in 2001 and could proceed before South Australia's "No New Mine" policy goes into effect (table 24).

Environment

In Japan, the amended Enforcement Order of Industrial Safety and Health Law, which largely prohibited the use of asbestos in buildings as insulation and in roof tiles, took effect in 2004. The Government decided in 2005 to draft legislation to extend relief to families of asbestos victims eligible for the same benefits as the workers' accident compensation. The Government also ratified the International Labor Organization Convention 162 on safety in the use of asbestos. The convention was expected to take effect in Japan in 2006. In Thailand, the Klity case that involved water pollution related to lead mining was still unresolved. The village of Klity in Kanchanaburi Province had long suffered from lead poisoning related to lead sediment and contamination in the Klity Creek from a lead mine that discharged waste into the creek. The cadmium contamination problem in the vicinity of Mae Tao Creek around the mine, which was operated by Padaeng Industry Public Co. Ltd., had emanated from natural sources and from human activities including industry, deforestation, forestry firing, and human settlements that had aggravated the natural process.

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TABLE 1
ASIA AND THE PACIFIC: AREA AND POPULATION IN 2005

Country	Area[1] total (square kilometers)	Population[2] total (thousands)
Afghanistan	647,500	29,929 [1]
Australia	7,687,850	20,321
Bangladesh	144,000	141,822
Bhutan	47,000	918
Brunei	5,770	361
Burma	678,500	50,519
Cambodia	181,040	14,071
China	9,596,960	1,304,500
Fiji	18,270	848
Hong Kong	1,092	6,944
India	3,287,590	1,094,583
Indonesia	1,919,440	220,558
Japan	377,835	127,956
Korea, North	120,540	22,488
Korea, Republic of	98,480	48,294
Laos	236,800	5,924
Malaysia	329,750	25,347
Mongolia	1,565,000	2,554
Nepal	140,800	27,133
New Caledonia	19,060	234
New Zealand	268,680	4,110
Pakistan	803,940	155,772
Papua New Guinea	462,840	5,887
Philippines	300,000	83,054
Singapore	692	4,351
Solomon Islands	28,450	478
Sri Lanka	65,610	19,582
Taiwan	35,980	22,894 [1]
Thailand	514,000	64,233
Timor, East	15,007	976
Vietnam	329,560	82,966
Total	29,928,036	3,589,607
World Total	148,940,000	6,345,127

[1]Source: U.S. Central Intelligence Agency World Factbook 2006.
[2]Source: World Bank 2006, World Development Indicators Database.

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TABLE 2

ASIA AND THE PACIFIC: ECONOMY IN 2005[1, 2]

Country	Gross domestic product based on purchasing power parity		Real gross domestic product growth rate (percentage)		
	Total (million dollars)	Per capita (dollars)	2004	2005	2007
Afghanistan	31,868	1,310	8.0	13.8	10.6
Australia	630,139	30,897	3.6	2.5	3.2
Bangladesh	305,640	2,011	5.9	5.8	6.3
Bhutan	3,007	3,921	8.7	6.5	11.5
Brunei	9,009	24,856	1.7	3.0	2.3
Burma	93,766	1,691	3.0	5.0	3.5
Cambodia	34,670	2,399	7.7	7.0	6.0
China	9,412,361	7,204	10.1	9.9	9.0
Fiji	5,447	6,374	4.1	2.1	1.8
Hong Kong	233,374	33,411	8.6	7.3	4.5
India	3,633,441	3,344	8.1	8.3	7.0
Indonesia	977,419	4,458	5.1	5.6	6.0
Japan	3,910,728	30,615	2.3	2.7	2.1
Korea, North[3]	40,000	1,800	2.2	1.0	NA
Korea, Republic of	994,399	20,590	4.6	4.0	4.5
Laos	12,547	2,124	6.4	7.0	6.0
Malaysia	290,683	11,201	7.1	5.3	5.8
Mongolia	5,561	2,175	10.7	6.2	6.0
Nepal	39,136	1,675	3.8	2.7	3.0
New Caledonia[4]	3,158	1,500	NA	NA	NA
New Zealand	101,685	24,769	4.4	2.2	2.1
Pakistan	404,592	2,628	7.1	7.0	6.3
Papua New Guinea	14,363	2,418	2.9	3.0	3.5
Philippines	414,705	4,923	6.0	5.1	5.6
Singapore	123,441	28,100	8.7	6.4	4.5
Solomon Islands	911	1,894	5.5	5.2	4.5
Sri Lanka	86,004	4,384	5.4	5.9	6.2
Taiwan	631,220	27,572	6.1	4.1	4.5
Thailand	544,834	8,319	6.2	4.4	5.4
Timor, East	NA	NA	1.8	3.2	4.6
Vietnam	251,609	3,025	7.7	7.5	7.4
Total	23,239,717	XX	XX	XX	XX
World total	61,078,260	XX	XX	XX	XX

NA Not available. XX Not applicable.

[1]Includes data available as of April 2006. Gross domestic product listed may differ from that reported in individual country chapters owing to differences in source or date of reporting.

[2]Source: International Monetary Fund, World Economic Outlook Database, April 2006.

[3]Source: U.S. Central Intelligence Agency World Factbook 2006.

[4]Based on 2003 estimate, U.S. Central Intelligence Agency World Factbook 2006.

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TABLE 3

ASIA AND THE PACIFIC: SELECTED EXPLORATION SITES IN 2005

Country	Type[1]	Site	Commodity[2]	Company	Resources[2, 3]	Activity[4]
Australia	F	Christmas Creek/Cloud Break	Fe	Fortescue Metals Group Ltd.	625 Mt Fe	Extensive work program.
Do.	D	East Aloha/Beta Hunt	Ni	Reliance Mining Ltd.	37,600 t Ni	Do.
Do.	D	Gidgee	Au	Legend Mining Ltd.	320,000 oz Au	Extensive drilling.
Do.	p	Meckatharra/Yaloginda	Au	Mercator Gold plc	690,000 oz Au	Do.
Do.	E	Menninnie	Pb, Zn, Cu, Au	Terramin Australia Ltd.	Data not released	Do.
Do.	E	Nolans Bore	REO, phosphate	Anafura Resources NL	325,000 t REO, 1.4 Mt P_2O_5	Do.
Do.	P	Norseman/Mararoa Reef	Au	Croesus Mining NL	544,800 oz Au	Do.
Do.	F	Roseby	Cu, Au	Universal Resources Ltd.	888,000 t Cu, 241,000 oz Au	Do.
Do.	E	Southdown	Fe	Grange Resources Ltd.	105 Mt Fe	Do.
Do.	E	Spinifex Ridge	Mo, Cu	Moly Mines Ltd.	154,000 t Mo, 220,000 t Cu	Do.
China	E	Boka	Au	Southwestern Resources Corp.	963,000 oz Au	Extensive work program.
Do.	D	Jinfeng	Au	Sino Gold Ltd.	2.8 Moz Au	Extensive drilling.
Do.	F	Maoling	Au	Mundoro Mining Inc.	3.8 Moz Au	Do.
Do.	E	Xietongmen	Cu, Au	Continental Minerals Corp.	Data not released	Do.
Indonesia	P	Grasberg/Deep MLZ	Cu, Au, Ag	PT Freeport Indonesia	30 Mt Cu, 86 Moz Au, 342 Moz Ag	Extensive work program.
Malaysia	P	Penjom	Au	Avocet Mining plc	990,000 oz Au	Extensive drilling.
Mongolia	D	Oyu Tolgai	Cu, Au	Ivanhoe Mines Ltd.	14.6 Mt Cu, 17.7 Moz Au	Extensive work program.
Pakistan	F	Reko Diq	Cu, Au	Tethyan Copper Company Ltd.	6.8 Mt Cu, 9.8 Moz Au	Extensive drilling.
Papua New Guinea	F	Simberi	Au	Allied Gold Company Ltd.	2.27 Moz Au	Do.
Thailand	P	Chatree North	Au	Kingsgate Consolidated Ltd.	1.92 Moz Au	Do.

[1]D--Approved for development; E--Active exploration; F--Feasibility work ongoing/completed; P--Exploration at producing site.

[2]Abbreviations used for commodities in this table include the following: Ag--silver; Au--gold; Cu--copper; Fe--iron ore; Mo--molybdenum; Ni--nickel; Pb--lead; REO--rare earths; Zn--zinc.

Abbreviations used for units of measure include the following: Moz-million troy ounces; Mt-million metric tons; oz-troy ounces; t-metric tons.

[3]Resources reported where available based on 2005 data from various sources and reflect unverified public information reported by trade journals.

[4]Sites where extensive (greater than 10,000 meters) drilling or significant (more than $5 million) expenditure have been reported.

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TABLE 4

ASIA AND THE PACIFIC: PRODUCTION OF SELECTED COMMODITIES IN 2005[1]

(Thousand metric tons unless otherwise specified)

	Metals										
				Copper		Gold, mine	Iron and steel			Lead	
	Aluminum			Mine		output,	Iron			Mine	
				output,	Refined,	Au content	Ore, gross			output,	Refined,
Country	Alumina	Bauxite	Metal[2]	Cu content	primary	(kilograms)	weight	Pig	Steel, crude	Pb content	primary
Afghanistan	--	--	--	NA	--	--	--	--	--	--	--
Australia	17,704	59,959	2,030	918	461	263,000	261,900	6,648	7,788	767	230
Bangladesh	--	--	--	--	--	--	--	--	20 e	--	--
Bhutan	--	--	--	--	--	--	6	--	--	--	--
Brunei	--	--	--	--	--	--	--	--	--	--	--
Burma	--	--	--	35	35	90 e	--	2 e	25 e	2 e	1
Cambodia	--	--	--	--	--	--	--	--	--	--	--
China[e]	8,610	18,000	7,800	762	1,850	225,000	420,000	343,750 3	353,240 3	1,000	1,870
Christmas Island[4]	--	--	--	--	--	--	--	--	--	--	--
Fiji	--	--	--	--	--	3,800 e	--	--	--	--	--
Hong Kong[4]	--	--	--	--	--	--	--	--	--	--	--
India[e]	2,700	11,957 3	898 3	27 3	517	--	140,000	25,500	34,000	42 3	44 3
Indonesia	--	1,442	252 e	1,041	263	130,620	--	1,268	3,675	--	--
Japan	350 e	--	1,087	--	1,228	8,318	--	83,058	112,471	3	107
Korea, North[e]	--	--	--	12	15	6,000	5,000	900	1,070	20	9
Korea, Republic of	--	--	--	(5)	518	266	305	27,309	47,770	(5)	181
Laos	--	--	--	--	30	6,338	--	--	--	--	--
Malaysia	--	5	--	--	--	4,250	950	--	5,296	--	--
Mongolia	--	--	--	127	2	24,120	168	--	66	--	--
Nauru[4]	--	--	--	--	--	--	--	--	--	--	--
Nepal	--	--	--	--	--	--	--	--	--	--	--
New Caledonia	--	--	--	--	--	--	--	--	--	--	--
New Zealand	--	--	373	--	--	10,583	--	590 e	813 e	--	--
Pakistan	--	7	--	--	--	--	104	NA	700 e	--	--
Papua New Guinea	--	--	--	193	--	66,700 e	--	--	--	--	--
Philippines	--	--	--	16	172	37,490	--	--	550 e	--	--
Singapore	--	--	--	--	--	--	--	--	--	--	--
Solomon Islands	--	--	--	--	--	--	--	--	--	--	--
Sri Lanka	--	--	--	--	--	--	--	--	--	--	--
Taiwan	--	--	--	--	--	--	--	9,854	18,567	--	--
Thailand	--	--	--	--	28	4,400	220	--	5,161	--	--
Vietnam[e]	--	20	--	2	--	3,000	700	--	780	1	--
Total	29,400	91,400	12,400	3,130	5,120	794,000	829,000	499,000	592,000	1,800	2,440
Share of world total	46%	53%	34%	21%	35%	32%	54%	63%	52%	55%	65%
United States	5,220	NA	2,480	1,140	1,210	261,000	54,400	37,200	93,300	426	143
World total	63,400	172,000	37,000	15,000	14,700	2,470,000	1,530,000	794,000	1,130,000	3,360	3,740

See footnotes at end of table.

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TABLE 4—Continued

ASIA AND THE PACIFIC: PRODUCTION OF SELECTED COMMODITIES IN 2005[1]

(Thousand metric tons unless otherwise specified)

Country	Metals								
	Manganese ore, mine output, Mn content	Mercury, mine output, Hg content (metric tons)	Nickel, metal content		Tin, metric tons		Tungsten, mine output, W content (metric tons)	Zinc, metric tons	
			Mine output	Refinery products	Mine output, Sn content	Metal, primary		Mine output, Zn content	Metal[2]
Afghanistan	--	--	--	--	--	--	--	--	--
Australia	1,500	--	189	122	2,819	594	--	1,367,000	463,000
Bangladesh	--	--	--	--	--	--	--	--	--
Bhutan	--	--	--	--	--	--	--	--	--
Brunei	--	--	--	--	--	--	--	--	--
Burma	(5)	--	(5)	--	708	30 e	168	78	--
Cambodia	--	--	--	--	--	--	--	--	--
China[e]	1,200	1,100	77	95	120,000	125,000	61,000	2,450,000	2,800,000
Christmas Island[4]	--	--	--	--	--	--	--	--	--
Fiji	--	--	--	--	--	--	--	--	--
Hong Kong[4]	--	--	--	--	--	--	--	--	--
India[e]	640	--	--	--	--	--	--	200,000	293,000
Indonesia	--	--	160	7	90,000	65,300	--	--	--
Japan	--	--	--	165	--	754	--	41,452	675,221
Korea, North[e]	--	--	--	--	--	--	600	67,000	72,000
Korea, Republic of	--	--	--	26	--	--	--	80	644,828
Laos	--	--	--	--	450 e	--	--	1,100 e	--
Malaysia	--	--	--	--	2,857	36,924	--	--	--
Mongolia	--	--	--	--	--	--	78 e	--	--
Nauru[4]	--	--	--	--	--	--	--	--	--
Nepal	--	--	--	--	--	--	--	--	--
New Caledonia	--	--	111 p	47	--	--	--	--	--
New Zealand	--	--	--	--	--	--	--	--	--
Pakistan	--	--	--	--	--	--	--	--	--
Papua New Guinea	--	--	--	--	--	--	--	--	--
Philippines	--	--	23	--	--	--	--	--	--
Singapore	--	--	--	--	--	--	--	--	--
Solomon Islands	--	--	--	--	--	--	--	--	--
Sri Lanka	--	--	--	--	--	--	--	--	--
Taiwan	--	--	--	11 e	--	--	--	--	--
Thailand	42	--	--	--	206	31,600	190 e	42,570	101,186
Vietnam[e]	--	--	--	--	3,500	3,500	--	32,000	--
Total	3,400	1,100	560	473	221,000	264,000	62,000	4,200,000	5,050,000
Share of world total	33%	77%	37%	35%	73%	79%	87%	44%	49%
United States	--	NA	--	--	--	--	--	748,000	309,000
World total	10,400	1,420	1,500	1,370	303,000	333,000	71,300	9,560,000	10,300,000

See footnotes at end of table.

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TABLE 4—Continued

ASIA AND THE PACIFIC: PRODUCTION OF SELECTED COMMODITIES IN 2005[1]

(Thousand metric tons unless otherwise specified)

	Industrial minerals						Mineral fuels			
							Coal			
Country	Cement, hydraulic	Fluorspar (metric tons)	Graphite (metric tons)	Magnesite	Mica (metric tons)	Salt	Anthracite	Bituminous	Natural gas, dry (million cubic meters)	Petroleum, crude (thousand 42-gallon barrels)
Afghanistan	NA	--	--	--	--	NA	--	NA	NA	--
Australia	8,000 e	--	--	474	--	12,444	--	303,000	42,630	155,320
Bangladesh	5,100 e	--	--	--	--	350	--	--	9,400 e	1,900 e
Bhutan	170 e	--	--	--	--	--	--	85	--	--
Brunei	266	--	--	--	--	--	--	--	13,000 e	70,000 e
Burma	543	--	--	--	--	35 e	--	--	11,648	8,133
Cambodia	--	--	--	--	--	40 e	--	--	--	--
China[e]	1,068,850 3	2,700,000	720,000	4,700	--	46,610 3	245,000	1,850,000	42,000	1,350,000
Christmas Island[4]	--	--	--	--	--	--	--	--	--	--
Fiji	100 e	--	--	--	--	--	--	--	--	--
Hong Kong[4]	NA	--	--	--	--	--	--	--	--	--
India[e]	130,000	10,900	130,000	380	3,700	15,503 3	--	333,000	27,000	248,000
Indonesia	33,917	--	--	--	--	680 e	50 e	142,920	53,000 e	352,000
Japan	69,629	--	--	--	--	1,227	--	1,146	3,265	5,774
Korea, North[e]	5,700	12,500	32,000	1,200	--	500	16,500	--	--	--
Korea, Republic of	51,391	--	39	--	36,623	379	2,832	--	--	--
Laos	350 e	--	--	--	--	15 e	--	--	--	--
Malaysia	17,860	--	--	--	4,542	--	--	789	59,111	267,720
Mongolia	112 e	367,000	--	--	--	2	--	8,256	--	201
Nauru[4]	--	--	--	--	--	--	--	--	--	--
Nepal	290 e	--	--	--	--	2	--	9	--	--
New Caledonia	119 p	--	--	--	--	--	--	--	--	--
New Zealand	1,050 e	--	--	--	--	100 e	--	5,267	3,911	7,032
Pakistan	10,600 e	1,040	--	3	--	1,662	--	3,367	34,000	24,119
Papua New Guinea	--	--	--	--	--	--	--	--	1,365	16,800
Philippines	15,494	--	--	--	--	421	--	3,165	--	208 e
Singapore	--	--	--	--	--	--	--	--	--	--
Solomon Islands	--	--	--	--	--	--	--	--	--	--
Sri Lanka	1,500 e	--	3,000 e	--	1,700 e	80 e	--	--	--	--
Taiwan	19,891	--	--	--	8,608	--	--	--	490 e	203
Thailand	37,872	295	--	--	--	1,100	--	--	23,690	41,320
Vietnam[e]	29,000 3	3,000	--	--	--	1,400	32,800 3	--	6,340 3	135,578 3
Total	1,510,000	3,090,000	885,000	6,800	55,200	82,600	297,000	2,650,000	331,000	2,680,000
Share of world total	65%	56%	87%	49%	18%	33%	89%	59%	12%	10%
United States	101,000	--	--	W	99,200	46,500	1,550	949,000	537,000	1,890,000
World total	2,310,000	5,570,000	1,010,000	13,700	306,000	249,000	333,000	4,510,000	2,820,000	27,300,000

See footnotes at end of table.

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TABLE 4—Continued

ASIA AND THE PACIFIC: PRODUCTION OF SELECTED COMMODITIES IN 2005[1]

[e]Estimated; estimated data, U.S. data, and world totals are rounded to no more than three significant digits. [p]Preliminary. NA Not available. W Withheld to avoid disclosing company proprietary data; not included in world total. -- Zero or zero percent.

[1]Totals may not add due to independent rounding. Percentages are calculated on unrounded data. Table includes data available as of March 2007.

[2]Primary and secondary production.

[3]Reported figure.

[4]Not included as a separate chapter in USGS Minerals Yearbook 2005, volume III.

[5]Less than 1/2 unit.

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TABLE 5

ASIA AND THE PACIFIC: HISTORIC AND PROJECTED BAUXITE MINE PRODUCTION, 1990-2011[1]

(Thousand metric tons, gross weight)

Country	1990	1995	2000	2005	2007[e]	2009[e]	2011[e]
Australia	41,400	42,700	53,800	59,960	57,000	60,000	63,000
China	2,400	5,000	9,000	18,000	20,000	22,000	25,000
India	4,850	5,240	7,560	11,957	14,000	16,000	18,000
Indonesia	1,210	899	1,150	1,442	1,700	1,900	2,100
Malaysia	398	184	123	5	--	--	--
Other	3	3	9	27	25	25	1,700
Total	50,300	54,000	71,600	91,400	93,000	100,000	110,000

[e]Estimated. -- Negligible or no production.

[1]Historic data, estimated data, and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 6

ASIA AND THE PACIFIC: HISTORIC AND PROJECTED PRIMARY ALUMINUM METAL PRODUCTION, 1990-2011[1]

(Thousand metric tons)

Country	1990	1995	2000	2005	2007[e]	2009[e]	2011[e]
Australia	1,230	1,300	1,770	1,903	2,200	2,500	3,500
China	847	1,750	2,800	7,800	9,400	10,000	10,000
India	433	537	644	898	890	910	930
Indonesia	186	220	160	252	240	250	250
New Zealand	260	273	328	352	350	350	450
Other	34	18	7	7	410	610	710
Total	2,990	4,100	5,710	11,200	13,500	14,500	16,000

[e]Estimated.

[1]Historic data, estimated data, and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 7

ASIA AND THE PACIFIC: HISTORIC AND PROJECTED SECONDARY ALUMINUM METAL PRODUCTION, 1990-2011[1]

(Thousand metric tons)

Country	1990	1995	2000	2005	2007[e]	2009[e]	2011[e]
China	7	12	175	300	350	400	600
Japan	1,100	1,200	1,210	1,035	1,000	1,000	1,000
Total	1,110	1,210	1,390	1,340	1,350	1,400	1,600

[e]Estimated.

[1]Historic data, estimated data, and totals are rounded to no more than three significant digits; may not add to totals shown.

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TABLE 8

ASIA AND THE PACIFIC: HISTORIC AND PROJECTED COPPER MINE PRODUCTION, 1990-2011[1]

(Metal content in thousand metric tons)

Country	1990	1995	2000	2005	2007[e]	2009[e]	2011[e]
Australia	327	398	829	918	950	1,050	1,200
China	285	445	593	762	850	900	950
India	58	47	32	29	28	26	26
Indonesia	164	444	1,010	1,041	725	900	1,100
Mongolia	124	122	125	126	130	190	300
Papua New Guinea	170	213	203	190	210	200	200
Philippines	182	108	130	20	16	16	16
Other	25	26	44	85	140	250	380
Total	1,340	1,800	2,970	3,170	3,050	3,530	4,170

[e]Estimated.

[1]Historic data, estimated data, and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 9

ASIA AND THE PACIFIC: HISTORIC AND PROJECTED REFINED COPPER METAL PRODUCTION, 1990-2011[1]

(Thousand metric tons)

Country	1990	1995	2000	2005	2007[e]	2009[e]	2011[e]
Australia	274	248	488	461	550	700	750
China	560	1,080	1,370	2,600	3,000	3,300	3,600
India	42	40	243	517	700	750	800
Indonesia	--	--	158	262	240	240	300
Japan	1,010	1,190	1,440	1,228	1,600	1,700	1,700
Korea, Republic of	186	235	468	520	530	530	530
Other	161	187	195	252	400	450	550
Total	2,230	2,980	4,360	5,840	7,000	7,700	8,200

[e]Estimated. -- Negligible or no production.

[1]Historic data, estimated data, and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 10

ASIA AND THE PACIFIC: HISTORIC AND PROJECTED GOLD MINE PRODUCTION, 1990-2011[1]

(Metal content in kilograms)

Country	1990	1995	2000	2005	2007[e]	2009[e]	2011[e]
Australia	244,000	254,000	269,000	263,000	270,000	300,000	350,000
China	100,000	140,000	180,000	225,000	230,000	250,000	260,000
Indonesia	11,200	64,000	125,000	130,620	195,000	200,000	210,000
Japan	7,300	9,190	8,400	8,300	8,200	8,200	8,200
Korea, North	5,000	5,000	6,600	6,000	6,000	6,000	6,000
Mongolia	1,000	4,500	11,800	24,120	26,000	30,000	33,000
New Zealand	4,630	12,100	9,880	10,583	11,000	12,000	13,000
Papua New Guinea	31,900	51,700	74,500	66,700	72,000	74,000	80,000
Philippines	24,600	27,000	36,500	37,490	38,900	38,000	48,000
Other	9,940	9,330	17,400	25,306	30,500	32,100	31,800
Total	440,000	577,000	739,000	797,000	888,000	949,000	1,040,000

[e]Estimated.

[1]Historic data, estimated data, and totals are rounded to no more than three significant digits; may not add to totals shown.

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TABLE 11

ASIA AND THE PACIFIC: HISTORIC AND PROJECTED BENEFICIATED IRON ORE PRODUCTION, 1990-2011[1]

(Metal content in thousand metric tons)

Country	Average ore grade (% Fe)	1990	1995	2000	2005	2007[e]	2009[e]	2011[e]
Australia	64	69,800	88,700	107,000	175,300	200,000	210,000	220,000
China	64	55,000	82,300	73,600	134,000	150,000	160,000	165,000
India	64	34,400	41,700	48,600	90,000	92,000	94,000	96,000
Korea, North	NA	4,700	2,000	1,100	1,400	1,500	1,500	5,000
Other	XX	986	1,140	1,350	1,606	1,980	2,000	2,000
Total	XX	165,000	216,000	232,000	402,000	445,000	468,000	488,000

[e]Estimated. NA Not available. XX Not applicable.

[1]Historic data, estimated data, and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 12

ASIA AND THE PACIFIC: HISTORIC AND PROJECTED CRUDE STEEL PRODUCTION, 1990-2011[1]

(Thousand metric tons)

Country	1990	1995	2000	2005	2007[e]	2009[e]	2011[e]
Australia	6,670	8,450	7,300	7,790	10,000	10,000	20,000
China	66,100	95,400	129,000	353,240	440,000	460,000	510,000
India	15,000	22,800	26,900	34,000	35,000	39,000	42,000
Japan	110,000	102,000	106,000	112,470	113,000	113,000	113,000
Korea, Republic of	23,100	36,800	43,100	47,770	49,000	51,000	51,000
Malaysia	1,200	2,450	2,430	5,300	5,400	5,500	5,500
Taiwan	9,750	11,600	17,300	18,570	21,000	21,500	22,000
Thailand	685	2,130	2,100	5,160	5,200	5,400	6,000
Other	13,400	14,900	6,030	7,700	8,800	9,300	9,600
Total	246,000	297,000	340,000	592,000	687,000	715,000	779,000

[e]Estimated.

[1]Historic data, estimated data, and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 13

ASIA AND THE PACIFIC: HISTORIC AND PROJECTED LEAD MINE PRODUCTION, 1990-2011[1]

(Metal content in metric tons)

Country	1990	1995	2000	2005	2007[e]	2009[e]	2011[e]
Australia	570,000	455,000	739,000	767,000	800,000	800,000	810,000
China	315,000	520,000	660,000	1,000,000	1,000,000	1,100,000	1,200,000
India	23,200	34,000	28,900	42,000	43,000	44,000	45,000
Japan	18,700	9,660	8,840	3,437	--	--	--
Korea, North	80,000	75,000	9,000	20,000	20,000	20,000	20,000
Vietnam	--	1,000	1,000	1,200	1,000	1,000	1,000
Other	24,900	12,100	16,800	2,000	4,000	4,000	4,000
Total	1,030,000	1,110,000	1,460,000	1,840,000	1,870,000	1,970,000	2,080,000

[e]Estimated. -- Negligible or no production.

[1]Historic data, estimated data, and totals are rounded to no more than three significant digits; may not add to totals shown.

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TABLE 14

ASIA AND THE PACIFIC: HISTORIC AND PROJECTED PRIMARY REFINED LEAD PRODUCTION, 1990-2011[1]

(Thousand metric tons)

Country	1990	1995	2000	2005	2007[e]	2009[e]	2011[e]
Australia	212	215	223	230	240	250	266
China	260	458	998	1,870	1,900	2,000	2,200
India	29	62	57	44	50	55	60
Japan	205	148	130	107	95	95	95
Korea, North	70	65	7	9	9	9	9
Korea, Republic of	61	130	171	174	175	175	175
Other	2	10	4	1	--	--	--
Total	839	1,090	1,590	2,440	2,470	2,580	2,810

[e]Estimated.

[1]Historic data, estimated data, and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 15

ASIA AND THE PACIFIC: HISTORIC AND PROJECTED SECONDARY REFINED LEAD PRODUCTION, 1990-2011[1]

(Thousand metric tons)

Country	1990	1995	2000	2005	2007[e]	2009[e]	2011[e]
Australia	17	26	28	33	40	40	40
China	36	150	102	520	400	450	500
India	17	28	21	25	28	30	30
Japan	122	140	182	167	195	200	200
Malaysia	16	34	35	40	42	42	42
Philippines	12	17	16	30	30	30	30
Thailand	16	11	24	58	58	58	58
Other	16	25	12	12	12	12	12
Total	252	431	420	885	800	860	910

[e]Estimated.

[1]Historic data, estimated data, and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 16

ASIA AND THE PACIFIC: HISTORIC AND PROJECTED NICKEL MINE PRODUCTION, 1990-2011[1]

(Metal content in metric tons)

Country	1990	1995	2000	2005	2007[e]	2009[e]	2011[e]
Australia	67,800	103,000	167,000	189,000	230,000	250,000	350,000
China	33,000	41,800	50,300	77,000	79,000	81,000	82,000
Indonesia	68,300	88,200	98,200	160,000	160,000	180,000	180,000
New Caledonia	85,100	120,000	126,000	111,039	125,000	150,000	160,000
Philippines	15,800	15,100	17,400	22,560	35,000	35,000	27,000
Total	270,000	368,000	459,000	560,000	629,000	696,000	799,000

[e]Estimated.

[1]Historic data, estimated data, and totals are rounded to no more than three significant digits; may not add to totals shown.

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TABLE 17

ASIA AND THE PACIFIC: HISTORIC AND PROJECTED PLATINUM MINE PRODUCTION, 1990-2011[1]

(Metal content in kilograms)

Country	1990	1995	2000	2005	2007[e]	2009[e]	2011[e]
Australia	100	100	171	200	230	230	300
China	260	300	650	700	850	900	1,000
Total	360	400	821	900	1,080	1,130	1,300

[e]Estimated.

[1]Historic data, estimated data, and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 18

ASIA AND THE PACIFIC: HISTORIC AND PROJECTED PALLADIUM MINE PRODUCTION, 1990-2011[1]

(Metal content in kilograms)

Country	1990	1995	2000	2005	2007[e]	2009[e]	2011[e]
Australia	400	400	812	800	950	1,000	1,000
China	130	170	350	450	500	550	650
Total	530	570	1,160	1,250	1,450	1,550	1,650

[e]Estimated.

[1]Historic data, estimated data, and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 19

ASIA AND THE PACIFIC: HISTORIC AND PROJECTED ZINC MINE PRODUCTION, 1990-2011[1]

(Metal content in thousand metric tons)

Country	1990	1995	2000	2005	2007[e]	2009[e]	2011[e]
Australia	933	937	1,420	1,367	1,600	1,800	2,500
China	619	1,010	1,780	2,450	2,300	2,500	2,600
India	74	155	144	200	210	220	230
Japan	127	95	64	41	10	--	--
Korea, North	230	150	60	67	67	70	70
Thailand	11	23	27	43	40	40	40
Vietnam	10	14	13	32	40	50	50
Other	2	1	--	26	62	62	63
Total	2,010	2,390	3,510	4,230	4,330	4,700	5,600

[e]Estimated.

[1]Historic data, estimated data, and totals are rounded to no more than three significant digits; may not add to totals shown.

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TABLE 20

ASIA AND THE PACIFIC: HISTORIC AND PROJECTED ZINC METAL PRODUCTION, 1990-2011[1]

(Thousand metric tons)

Country	1990	1995	2000	2005	2007[e]	2009[e]	2011[e]
Australia	303	320	490	463	600	700	800
China	550	1,080	1,980	2,800	3,000	3,200	3,300
India	79	171	201	293	460	540	630
Japan	732	711	699	675	700	700	700
Korea, North	200	150	65	72	70	70	100
Korea, Republic of	248	279	474	645	680	700	700
Thailand	63	56	101	101	110	120	120
Total	2,180	2,770	4,010	5,050	5,600	6,000	6,350

[e]Estimated.

[1]Historic data, estimated data, and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 21

ASIA AND THE PACIFIC: HISTORIC AND PROJECTED DIAMOND PRODUCTION, 1990-2011[1]

(Thousand carats)

Country (average % gem grade)	1990	1995	2000	2005	2007[e]	2009[e]	2011[e]
Australia	34,600	40,700	26,600	54,703	28,000	30,000	30,000
China	1,000	1,130	1,150	100	100	100	100
India	15	21	16	16	18	19	20
Indonesia	23	22	23	30	30	30	30
Total	35,600	41,900	27,800	54,800	28,100	30,100	30,200

[e]Estimated.

[1]Historic data, estimated data, and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 22

ASIA AND THE PACIFIC: HISTORIC AND PROJECTED PHOSPHATE ROCK PRODUCTION, 1990-2011[1]

(P_2O_5 content in thousand metric tons)

Country	1990	1995	2000	2005	2007[e]	2009[e]	2011[e]
Australia	--	1	225	220	300	300	300
China	6,400	7,960	5,820	9,130	9,500	9,600	9,700
India	181	360	336	355	360	370	380
Philippines	3	8	109	100	100	100	100
Vietnam	96	178	236	240	240	250	250
Other	291	379	374	261	242	203	178
Total	6,970	8,890	7,100	10,300	10,700	10,800	10,900

[e]Estimated. -- Negligible or no production.

[1]Historic data, estimated data, and totals are rounded to no more than three significant digits; may not add to totals shown.

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TABLE 23

ASIA AND THE PACIFIC: HISTORIC AND PROJECTED SALABLE COAL PRODUCTION, 1990-2011[1]

(Thousand metric tons)

Country	1990	1995	2000	2005	2007[e]	2009[e]	2011[e]
Australia	199,000	194,000	313,000	370,000	352,000	355,000	456,000
China	1,010,000	1,310,000	957,000	2,150,000	2,250,000	2,400,000	2,600,000
India	226,000	290,000	335,000	360,000	370,000	437,000	504,000
Indonesia	10,000	40,000	77,200	142,970	160,000	170,000	180,000
Japan	7,980	6,260	3,130	1,146	--	--	--
Korea, North	68,000	70,000	22,500	23,500	26,000	26,000	26,000
Korea, Republic of	17,200	5,720	4,170	2,832	3,400	3,400	3,400
Mongolia	7,160	5,020	5,190	8,256	8,000	10,000	12,000
New Zealand	2,580	3,450	3,590	5,267	5,600	5,600	5,700
Pakistan	2,730	3,000	3,120	3,367	3,380	3,400	3,440
Philippines	1,190	1,200	1,300	3,165	3,200	3,500	3,500
Thailand	14,200	18,400	17,786	20,643	21,000	22,000	23,000
Vietnam	4,020	8,350	11,600	32,800	3,300	35,000	40,000
Other	320	517	837	1,588	1,140	1,150	1,140
Total	1,570,000	1,960,000	1,760,000	3,130,000	3,210,000	3,470,000	3,860,000

[e]Estimated. -- Negligible or no production.

[1]Historic data, estimated data, and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 24

ASIA AND THE PACIFIC: HISTORIC AND PROJECTED URANIUM MINE PRODUCTION, 1990-2011[1]

(U_3O_8 content in metric tons)

Country	1990	1995	2000	2005	2007[e]	2009[e]	2011[e]
Australia	3,530	3,700	7,580	11,218	9,000	9,100	9,200
China	100	500	1,000	1,200	1,500	1,500	1,500
Total	3,630	4,200	8,580	12,400	10,500	10,600	10,700

[e]Estimated.

[1]Historic data, estimated data, and totals are rounded to no more than three significant digits; may not add to totals shown.

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THE MINERAL INDUSTRY OF AFGHANISTAN

By Travis Q. Lyday and Staff

Afghanistan, which literally means Land of the Afghan, is a mountainous land-locked country located in southwest Asia. It is bordered by Pakistan to the east and south, Iran to the west, Turkmenistan to the northwest, Tajikistan and Uzbekistan to the north, and China to the northeast.

Afghanistan is an extremely poor country with rugged terrain and a seasonally harsh climate. The country encompasses approximately 647,500 square kilometers (km^2) of land and is slightly smaller than Texas (U.S. Central Intelligence Agency, 2005§[1]). The population was estimated to be about 29.9 million in 2005.

Afghanistan's economic outlook has improved significantly since 2001 following the fall of the Taliban regime (1994-2001). The infusion of more than $4 billion in international assistance has aided the recovery of Afghanistan's agricultural sector, growth of the service sector, and reestablishment of market institutions. Afghanistan's 2005 gross domestic product (GDP) based on purchasing power parity was estimated to be $31.9 billion, exclusive of illicit opium production. The estimated GDP real growth rate for 2005 was 13.8%. The GDP per capita based on purchasing power parity was estimated to be $1,310 for 2005. The estimated GDP composition by sector for 2005 was 38% agriculture (excluding opium production), 24% industry, and 38% services (U.S. Central Intelligence Agency, 2005§).

The country has a history and a culture that go back more than 5,000 years. Afghanistan's recent history is marked by war and civil unrest. The Soviet Union invaded the country in 1979 but was forced to withdraw in 1989 by anti-Communist mujahideen rebels. Since the successful military operation against the Taliban in 2001 by the United States and coalition forces and anti-Taliban forces within Afghanistan, ongoing combat and guerilla operations have continued to affect mineral output adversely. In 2005, mineral production in Afghanistan was estimated to have included about 500,000 metric tons of cement, 20,000 barrels of crude oil, 50 million cubic meters of natural gas, and an unknown amount of gemstones.

Afghanistan's major natural resources include barite, coal, chromite, copper, iron ore, lead, extensive deposits of natural gas (proven reserves of 49.98 billion cubic meters), petroleum, precious and semiprecious gemstones, oil, salt, sulfur, talc, and zinc. The precious and semiprecious gemstones include the exotic lapis lazuli gem, aquamarine, kunzite, ruby, and tourmaline. Most of the gemstones were exported to Pakistan.

The overland transport system in Afghanistan remained in poor condition, with only 24% of the 34,789 kilometers (km) of highway paved. Afghanistan had about 1,200 km of inland waterway, which consisted chiefly of the Amu Darya River. River ports included Kheyrabad and Shirr Khan. In 2004, Afghanistan had 387 km of gas pipeline.

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THE MINERAL INDUSTRY OF AUSTRALIA

By Staff

The Commonwealth of Australia is a country that is part of Oceania, which is located between the Indian Ocean and the South Pacific Ocean. The country's land mass is 7,617,930 square kilometers (km^2) and encompasses the continent of Australia and adjacent islands, including King Island and Tasmania, Lord Howe Island, and Macquarie Island. Owing to its large mineral resources, Australia was one of the world's leading mineral producing countries. The country ranked among the top 10 countries worldwide in the production of bauxite, coal, cobalt, copper, gem and near-gem diamond, gold, iron ore, lithium, manganese ore, niobium, rare earths, and uranium.

Commodity Review

Metals

Aluminum.—Australia was the leading bauxite and alumina producing country in the world. Bauxite came from the Gove Mine in Northern Territory, the Weipa Mine in northern Queensland, and the Huntly, the Willowdale, and the Worsley mines in Western Australia. The construction of Comalco Ltd.'s (a subsidiary of the Rio Tinto Group) 1.4-million-metric-ton-per-year (Mt/yr) mine in Queensland was completed in early 2005. Capacity expansions of Alcoa World Alumina Australia's Pinjarra alumina refinery in Western Australia and Worsley Alumina Pty. Ltd.'s Worsley alumina refinery in Western Australia were scheduled to be completed in early 2006. Australia's alumina output capacity was projected to increase to 20.5 Mt/yr in 2006. Australia's alumina producers planned to further expand their output capacities at the Gove, the Wagerup, and the Worsley refineries in the next 3 years. Aluminum expansion projects included Hydro Aluminum Australia Pty Ltd.'s Kurri Kurri Surf aluminum smelter in New South Wales and Boyne Island Smelter at Gladstone in Queensland. The total additional aluminum output capacity would be 18,000 metric tons per year (t/yr) in 2006. With limited growth in Australia's aluminum production capacity projected for the next several years, exports of alumina from Australia could increase by up to 19 million metric tons (Mt) in 2010 (Australian Bureau of Agricultural and Resource Economics, 2006b, p. 7).

Copper.—Australia was one of the major copper producing countries in the world. In 2005, Australia produced more than 900,000 metric tons (t) of copper in concentrates, and production was expected to increase to more than 1 Mt in 2007 and later years because of increasing production from Tritton Resources Ltd.'s copper mine and Newcrest Mining Ltd.'s copper and gold mine. Several copper mine projects—Browns Oxide Mine in the Northern Territory, Enterprise Mine in Queensland, Jaguar Mine in Western Australia, Lady Annie Mine in Queensland, and Thalanga Mine in Queensland—were expected to start up in 2007. BHP Billiton plc was considering an expansion of the Olympic Dam Mine to 500,000 t/yr, and Oxiana Co.'s Prominent Hill copper and gold project in South Australia was under bankable feasibility study. In 2005, Australia exported 1.3 Mt of copper concentrates. Owing to the country's increased output, exports of copper concentrates were expected to increase during the next several years. Australia's refined copper output was about 450,000 t/yr, and output capacity was expected to increase to about 500,000 t/yr in 2007 because of the 20,000-t/yr expansion project underway at the Townsville copper refinery and the 15,000-t/yr greenfield Lady Annie project underway at Queensland. Australia exported more than 300,000 t/yr of refined copper (Australian Bureau of Agricultural and Resource Economics, 2006a, p. 155).

Gold.—Australia's gold mine output ranked second in the world after the Republic of South Africa. The country's gold resources occur and are mined in all States and in the Northern Territory, and much of the gold was produced from large open pit mines. The new Ballarat East mine in Victoria and Twin Hills mine in Queensland were put into operation in 2005. A number of gold mines, including the Bendigo mine in Victoria, the Fortnum mine in Western Australia, the Gully mine and the Union Reef mine in Northern Territory, and the Warrior mine in Queensland, were scheduled to be put into operation during the next 2 years. Owing to the expansion of mine output capacity, higher gold prices in the international market, and an increase in demand for gold jewelry in China, India, and the Middle East, production and export of gold from Australia were expected to increase in the future (Australian Bureau of Agricultural and Resource Economics, 2006c).

Iron and Steel.—In 2005, Australia's iron ore output ranked second in the world after Brazil. Owing to limited iron and steel output capacity, Australia exported about 90% of its iron ore output to such Asian countries as China, Japan, the Republic of Korea, and Taiwan. Since 2003, negotiated benchmark iron ore prices have more than doubled. High prices and increased demand for iron ore in Asian countries, especially China, stimulated substantial investment in new iron ore projects in Australia and other iron-ore-rich countries. Many of these projects were anticipated to come onstream in 2006 and later years.

Rio Tinto plc planned to expand the Yandicoogina Mine output capacity to 52 Mt/yr by adding16 Mt/yr of capacity. Mine expansion was scheduled to be completed in late 2007. BHP Billiton expanded its Brackman resource Orebody 18 and its Area C in the Pilbara region of Western Australia. BHP Billiton also planned to increase production capacity at its Newman Mine site to 63 Mt/yr in 2010 from 45 Mt/yr in 2006. By 2010, BHP Billiton will have a total iron ore output capacity of 152 Mt/yr in the Pilbara region. The Western Australian Government approved Rio Tinto and Hancock Prospecting Pty Ltd.'s joint-venture project, Hope Downs, which will have an output capacity of 22 Mt/yr in 2008. The Hope Downs deposit had iron ore reserves of 346 Mt at a grade of 61.6% iron (Rio Tinto plc, 2006). Several small development projects, such as the Jack Hills Mine, the Koolan Island Mine, and the Middleback Range

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Mine were expected to come onstream in 2007. Australia's iron ore production was expected to increase to 320 Mt in 2007.

Lead, Silver, and Zinc.—Australia's lead, silver, and zinc mines were predominantly based on zinc-rich ore bodies with zinc as the major component and lead and silver as byproducts. An exception was BHP Billiton's Cannington underground mine in Queensland where lead and silver were major components and zinc was a minor component.

Owing to low zinc metal prices during the early 21st century, several zinc mines were closed worldwide. Teck Cominco Corp. of Canada's Lennard Shelf mine was closed in 2003. During the same period, the expansion of zinc smelting capacity, especially in China, was faster than the increase in mine output capacity. The supply and demand gap in zinc concentrates was met by drawing from stockpiles. As a result of an increase in demand for zinc from China, prices of zinc on the international market increased substantially in 2005. Teck Cominco planned to reopen its Lennard Shelf mine in 2007. The Black Star zinc mine in Queensland was expected to begin operation in 2006. Several small zinc projects, including the Angas Zinc, the Browns Silver, the Hellyer Metals, and the Jaguar projects were in the planning stages. By 2011, Australia's zinc concentrates output could increase to 1.9 Mt/yr (Australian Bureau of Agricultural and Resource Economics, 2006a, p. 135).

Manganese.—Australia was one of the major manganese ore producing countries in the world. The Bootu Creek, the Groote Eylandt, and the Woodie Woodie Mines were the three operating manganese mines in the country. The Bootu Creek Mine, which is located 110 kilometers (km) north of Tennant Creek in the Northern Territory, was commissioned in late 2005. The mine was designed to produce 600,000 t/yr of lump and fine products that would be transported 900 km by rail to Darwin's East Arm Port for export. A $6.5 million expansion of Woodie Woodie Mine was also completed in 2005, and the output capacity of the mine increased to 1 Mt/yr. As a result of the new greenfield and brownfield expansion projects, Australia's manganese ore output increased in 2005 and was expected to continue to increase during the next several years (Geoscience Australia, 2006, p. 55).

Nickel.—Australia's main nickel ores were primary sulfides of nickel, which occur as lodes with mafic and ultramafic (iron- and magnesium-rich) igneous rocks. Western Australia had the largest nickel resources in Australia. Active operating nickel sulfide mines included BHP Billiton's Leinster and Mount Keith Mines; LionOre Mining International Ltd.'s Black Swan and Emily Ann Mines; Jubilee Mines NL's Cosmos Mine; Mincor Resources NL's Mitel and Wannaway Mines; International Gold NL's Long-Victor Mine; and Consolidated Mineral Ltd.'s Beta Hunt Mine.

Several new and expansion nickel mine projects were underway; they included BHP Billiton's Mt Keith project; Gladstone Pacific Ltd.'s Gladstone project; Jubilee Mines's Prospero project; LionOre's Black Swan, Honeymoon Well, and Maggie projects; and Western Areas NL's Flying Fox project. Refinery expansion at BHP Billiton's Yabulu plant was expected to be completed in 2007. After completion of all these projects, Australia's nickel mine output could reach 378,000 t; the production of nickel metal was expected to increase to 180,000 t in 2010 (Australian Bureau of Agricultural and Resource Economics, 2006a, p. 159).

Titanium.—Mineral sands deposits are concentrations of ilmenite, rutile, and zircon; they occur along the coast of eastern Australia from central New South Wales to Cape York in Queensland. Large relic beach deposits are found as far inland as Ouyen in Victoria in southwestern New South Wales, and in South Australia in more than 300,000 km^2 of the Murray Basin. In Western Australia, deposits are distributed from the southern tip of the State to Geraldton and are located at the coastline or as relic deposits of up to 35 km in length. The eastern deposits generally have a total heavy-mineral content of from 1% to 5% of approximately even amounts of ilmenite, rutile, and zircon. In Western Australia, the deposits also have a total heavy-mineral content of about the same or slightly higher percentage, but the ilmenite portion of this content approaches about 70%. Most of Australia's rutile and zircon output is exported. Ilmenite is upgraded to synthetic rutile that contains between about 92% and 94% TiO_2, and more than one-half of the production is exported.

BeMax Resources NL's Pooncarie project, which includes the Ginkgo and the Snapper deposits, is located in the northern part of the Murray Basin in New South Wales. The Ginkgo Mine was put into operation in late 2005. The Iluka Resources Ltd.'s Douglas project in Victoria was scheduled to begin operations in 2006 and to reach full production in 2007 with a combined production capacity of about 180,000 t/yr of rutile and zircon. Iluka Resources also planned to develop the northern Murray Basin deposits. Olympia Resources NL planned to develop the Keysbrook heavy-mineral sand resource, which is located south of Perth, in 2007 (Australian Bureau of Agricultural and Resource Economics, 2006a, p. 22).

Industrial Minerals

Diamond.—Australia was one of the leading diamond producing countries in the world. Diamond production was mainly from the Argyle Mine in Western Australia. In 2005, Rio Tinto invested $760 million to develop an underground block-caving operation; bringing the underground mine into full operation is expected to take 3 years. After full operation in 2008, output from the underground operation will account for 60% of Argyle's total output. The open pit operation will be shut down gradually (Geoscience Australia, 2006, p. 35).

Mineral Fuels

Coal.—Australia ranked behind China and India in the Asia and the Pacific region in coal output; the country, however, was the world's leading exporter of coal. In 2005, Australia exported more than 230 Mt of coal to such countries and areas as Japan, India, the Republic of Korea, and Taiwan (Australian Bureau of Agricultural and Resource Economics, 2006d, p. 19).

With limited transport and handling infrastructure in New South Wales and Queensland, coal exports were restricted from these regions. During the past several years, significant investment has been proposed to expand the transport and handling infrastructure. Australia's coal export capacity is

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expected to increase in the next 2 years. Several coal expansion projects are planned, including that of the Ashton, the Boggabri, the Tarawonga, and the Wambo mines in New South Wales in 2007. The upgrade of the Port of Newcastle was scheduled to be completed in 2007; this upgrade would increase the Port's total handling capacity to 102 Mt/yr. Construction of the Rolleston coal mine in Queensland was completed in 2005 and the mine was expected to produce 6 Mt in 2006 and to reach 12 Mt after the Phase 2 construction was completed later in the year. The expansion of the Dawson, the Ensham, the Grasstree, and the Hail Creek mines in Queensland were schedule to be completed in 2007. Port handling capacity in the Ports of Abbot Point, Dairymple Bay, Gladstone, and Hay Point would increase to a total of 198 Mt in 2008. Coal exports from Australia would increase to about 300 Mt in 2010 (Department of Industry Tourism and Resources, 2006, p. 18).

Natural Gas and Petroleum.—Western Australia and Victoria accounted for most of Australia's total oil and condensate and liquefied natural gas (LNG) production. The Carnarvon Basin in Western Australia accounted for 63% of the country's total production. Production from the Carnarvon Basin was mostly exported, and production from the Gippsland Basin in southeastern Australia was predominantly used to feed local refineries. During the past 5 years, Australia was a net importer of oil and its refinery products. With the startup of production at the Enfield project in the Carnarvon Basin and the Puffin project in the Banaparte Basin, Australia's oil and condensate production was expected to increase during the next several years. More than one-half of Australia's oil and condensate was exported to Asian countries, including Japan, the Republic of Korea, and Singapore. New Zealand and Singapore were Australia's leading markets for refinery products. Since the mid-1990s, Australian imports of oil from the Middle East have gradually decreased and have been replaced with oil imports from southeast Asian countries, such as Indonesia and Vietnam. Much of Australia's oilfields have matured; significant undiscovered oil and gas resources exist in the offshore regions, however, such as at the Gippsland Basin in Victoria, the Bonaparte Basin in the Northern Territory, and the Browse and the Carnarvon Basins in Western Australia (Department of Industry Tourism and Resources, 2006, p. 23).

With the expected increase in production from the Darwin and the Casino fields, Australia's natural gas output was expected to increase for the next several years. A number of new LNG agreements were signed between Australian oil and gas producers and Japanese energy companies. With such countries as China, Japan, and the Republic of Korea looking to secure sources of cleaner fuel for power generation, demand for Australia LNG exports was expected to increase and, in response, production of LNG was expected to increase during the next several years. Several natural gas and LNG projects, such as Camden Gas in New South Wales; Bass Gas, Kipper Gas, and Otway Gas in Victoria; and Angel Gas, Blacktip Gas, and Gorgon Gas in Western Australia, were expected to start up within the next 4 years (Department of Industry Tourism and Resources, 2006, p. 39).

Uranium.—Australia was the second leading uranium producer in the world following Canada. Australia's uranium production was mainly from three mines—the Beverley, the Olympic Dam, and the Ranger mines. A number of undeveloped deposits in the Northern Territory, Queensland, South Australia, and Western Australia also exist. The Australian Government permits uranium mining provided all the relevant environmental safeguards and health requirements are met. Regulation of Australia's uranium mines is mainly a State and Territorial government responsibility. Uranium mining is permitted only in the Northern Territory and South Australia. Recently, the policies of governments in the States of Queensland, South Australia, and Western Australia and the legislation in New South Wales and Victoria prevent the development of uranium mines in those jurisdictions. In South Australia, under the recent government's "no new mine" policy, projects that had previously received approval for development could proceed; existing mines could also continue to operate. The Honeymoon project, therefore, which was approved in 2001, was allowed to proceed. All Australia's uranium production was exported under long-term contracts to electricity utilities in Belgium, Finland, France, Germany, Japan, the Republic of Korea, Spain, Sweden, the United Kingdom, and the United States. The Governments of Australia and China signed a Nuclear Transfer Agreement and a Nuclear Cooperation Agreement. These agreements established strict safeguards to regulate the conditions under which uranium is exported from Australia to China (Australian Bureau of Agricultural and Resource Economics, 2006d, p. 53).

In 2005, the Ranger mine was the leading producing uranium mine in Australia and was expected to cease operation in 2020. BHP Billiton planned to expand Olympic Dam's uranium output to 15,000 t/yr from 4,400 t/yr in 2005; copper production from Olympic Dam would also increase to 500,000 t/yr. The expansion project faced infrastructure obstacles with increasing energy, transportation, and water requirements. The Federal and State governments imposed a limit on the volume of groundwater that could be extracted from the Great Artesian Basin aquifers for use in the Olympic Dam operation and the nearby township of Roxby Downs. The future of Australia's uranium production and exports will be affected by whether or not State government policy regarding the development of new uranium mines is changed. The timing of the proposed expansion of Olympic Dam and the commencement of the Honeymoon project in 2008 will also affect the volume of uranium output (Australian Bureau of Agricultural and Resource Economics, 2006d, p. 60).

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TABLE 1
AUSTRALIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2001	2002	2003	2004	2005
METALS						
Aluminum:						
Bauxite, gross weight	thousand metric tons	53,799	54,135	55,602	43,993	59,959
Alumina	do.	16,313	16,382	16,529	16,525	17,704
Metal, refined:						
Primary	do.	1,798	1,836	1,857	1,894	1,903
Secondary[e]		127,000	127,000	127,000	127,000	127,000
Antimony, Sb content of ores and concentrates		1,380	1,200 [e]	900 [e]	120	120 [e]
Cadmium:						
Mine output, Cd content[e]		1,900	1,900	1,900	1,900	1,900
Metal, smelter, refined		378	370	350	469	429
Chromium, chromite, gross weight		11,800	132,665	138,826	140,000 [e]	140,000
Cobalt:						
Co content in laterite ore, Ni concentrate, and Zn concentrate		6,200	6,500	7,000	7,000 [e]	7,000
Metal, refined		3,470	3,500 [e]	3,840	3,900 [e]	3,900
Copper:						
Mine output, Cu content	thousand metric tons	898 [r]	872 [r]	830	875 [r]	918
Metal:						
Smelter, primary and secondary	do.	455 [r]	456 [r]	418 [r]	440 [r]	410
Refined, primary	do.	558	543	484	498 [r]	461
Gold:						
Mine output, Au content		280 [r]	266 [r]	283 [r]	258 [r]	263
Metal, refined:						
Primary		305 [r]	302 [r]	331 [r]	313 [r]	291
Secondary		68	47 [r]	80 [r]	58 [r]	50
Iron and steel:						
Iron ore:						
Gross weight	thousand metric tons	181,200 [r]	187,200 [r]	213,000 [r]	243,000 [r]	261,900
Fe content	do.	112,592	113,548	116,355	143,980	175,300
Metal:						
Pig iron	do.	60,117 [r]	6,106 [r]	6,116 [r]	5,735 [r]	6,648
Ferroalloys:[e]						
Ferromanganese		115,000	115,000	115,000	115,000	115,000
Silicomanganese		135,000	135,000	135,000	135,000	135,000
Total		250,000	250,000	250,000	250,000	250,000
Steel, crude	thousand metric tons	8,227 [r]	8,874 [r]	9,678 [r]	8,353 [r]	7,788
Semimanufactured products		8,243 [r]	6,457 [r]	7,458 [r]	6,671 [r]	6,920
Lead:						
Mine output, Pb content	thousand metric tons	759 [r]	694 [r]	688	674 [r]	767
Metal:						
Bullion	do.	195	187 [r]	169	140 [r]	159
Refined:						
Primary	do.	237	268 [r]	270 [r]	232 [r]	230
Secondary excluding remelt	do.	34 [r]	36 [r]	25 [r]	36 [r]	33
Manganese ore, metallurgical:						
Gross weight	do.	1,961 [r]	2,189 [r]	2,564 [r]	3,431 [r]	3,136
Mn content	do.	948	983	1,247	1,570 [r]	1,500
Nickel:						
Mine output, Ni content	do.	197 [r]	188 [r]	191 [r]	187 [r]	189
Matte	do.	100	98	108	107	115
Metal, smelter, refined Ni and Ni content of oxide	do.	128	132 [r]	129 [r]	122 [r]	122
Platinum-group metals:[e]						
Palladium, Pd content	kilograms	828 [2]	800	820	800	800
Platinum, Pt content	do.	174 [2]	200	225	200	200
Total	do.	1,002 [2]	1,000	1,050	1,000	1,000

See footnotes at end of table.

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TABLE 1--Continued
AUSTRALIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2001	2002	2003	2004	2005
METALS--Continued						
Silver:						
Mine output, Ag content		1,970	2,077	1,868	2,224 r	2,417
Metal, refined		584 r	644 r	649 r	650	727
Tin:						
Mine output, Sn content		9,840 r	7,017 r	3,864 r	1,196 r	2,819
Metal, refined:						
Primary		1,094	791 r	597	467	594
Secondary[e]		400	400	400	400	400
Tantalum, tantalite, Ta_2O_5 equalvent		806	985	973	1,019	1,041
Titanium concentrates, gross weight:						
Ilmenite	thousand metric tons	2,019 r	1,954 r	2,006	1,921	2,030
Leucoxene		30,000	39,000	57,000	44,000	46,000
Rutile		207,000 r	219,000 r	173,000	163,000 r	177,000
Zinc:						
Mine output, Zn content	thousand metric tons	1,517 r	1,469	1,479	1,334	1,367
Metal, smelter:						
Primary	do.	556 r	567	553	470 r	457
Secondary[e]		6,000 r	6,000 r	6,000 r	6,000 r	6,000
Zirconium concentrates, gross weight	thousand metric tons	394	412	462	441 r	427
INDUSTRIAL MINERALS						
Abrasives, natural:[e]						
Beach pebble		2,000	2,000	2,000	2,000	2,000
Garnet		25,000	25,000	25,000	25,000	25,000
Barite[e]		20,000	20,000	20,000	20,000	20,000
Cement, hydraulic[e]	thousand metric tons	7,500	7,550	8,000	8,000	8,000
Clays:[e]						
Bentonite and bentonitic clay		180,000	200,000	200,000	200,000	200,000
Brick clay and shale	thousand metric tons	8,000	8,000	8,000	8,000	8,000
Cement clay and shale	do.	500	500	500	500	500
Damourite clay		100	100	100	100	100
Fire clay		25,000	25,000	25,000	25,000	25,000
Fuller's earth, attapulgite		5,600	6,000	6,000	6,000	6,000
Kaolin and ball clay		220,000	230,000	240,000	240,000	240,000
Other	thousand metric tons	1,000	1,000	2,000	2,000	2,000
Diamond:						
Gem	thousand carats	14,397	15,136	13,981	20,602	30,703
Industrial	do.	11,779	18,500	17,087	22,709	24,000 e
Total	do.	26,176	33,636	31,068	43,311	54,703
Diatomite[e]		20,000	20,000	20,000	20,000	20,000
Feldspar, including nepheline syenite[e]		50,000	50,000	50,000	50,000	50,000
Gemstones, other than diamond:						
Opal	value, $million	53	47	50	36	40 e
Sapphire	do.	5	1	--	--	-- e
Total	do.	58	48	50	36	40 e
Gypsum	thousand metric tons	3,225 r	4,268 r	4,066 r	4,325 r	3,857
Kyanite[e]		1,000	1,000	1,000	1,000	1,000
Lime[e]		1,500,000	1,500,000	1,500,000	1,500,000	1,500,000
Magnesite		605,314	484,314	472,668	473,983	474,000 e
Nitrogen, N content of ammonia		762,200	686,400	786,800	790,000	790,000
Perlite, crude[e]		5,000	5,000	5,000	5,000	5,000
Phosphate rock		977,100	2,024,580	2,100,000 e	2,200,000 e	2,200,000
Salt[3]	thousand metric tons	9,254 r	9,961 r	10,256	11,088	12,444
Stone and sand and gravel:						
Construction sand	do.	26,800 r	28,988 r	28,825 r	32,229 r	35,000 e
Crushed and broken stone	do.	70,400 r	68,369 r	75,649 r	89,179 r	90,000 e
Dimension stone	do.	132 r	143 r	147 r	258 r	260 e
Gravel	do.	9,858 r	12,155 r	12,718 r	18,850 r	20,000 e
Dolomite[e]	do.	10,000	10,000	10,000	10,000	10,000

See footnotes at end of table.

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TABLE 1--Continued
AUSTRALIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2001	2002	2003	2004	2005
INDUSTRIAL MINERALS--Continued						
Stone and sand and gravel--Continued:						
Limestone	thousand metric tons	15,215 r	18,333 r	17,076 r	17,211 r	17,500 e
Silica in the form of quartz, quartzite, glass sand	do.	4,472 r	4,046 r	4,181 r	3,670 r	3,600 e
Sulfur, byproduct:						
Metallurgy	do.	817	899	900 e	900 e	900 e
Petroleum	do.	45	60	60 e	60 e	60 e
Total	do.	862	959	960 e	960 e	960 e
Talc, chlorite, pyrophyllite, steatite		160,741 r	165,980 r	123,080 r	151,582 r	155,000 e
MINERAL FUELS AND RELATED MATERIALS						
Coal:						
Bituminous and subbituminous	thousand metric tons	264,680	274,850 r	280,700 r	298,000 r	303,000
Lignite e	do.	70,000	73,000	66,000 r	67,000	67,000 e
Total e	do.	335,000	421,000 r	346,700 r	365,000 r	370,000 e
Coke, metallurgical e	do.	800	300	300	300	300
Gas, natural, marketed	million cubic meters	34,820 r	36,200 r	37,410 r	41,680 r	42,630
Petroleum:						
Crude	thousand 42-gallon barrels	237,889 r	221,036 r	193,216 r	171,781 r	155,320
Refinery products	do.	293,589 r	293,878 r	273,518 r	280,242 r	255,863
Uranium, mine output, U_3O_8 content		7,680	3,536	8,912	10,600 r	11,218

eEstimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. rRevised. -- Zero.

[1]Table includes data available through January 25, 2007.

[2]Does not include production from the Northern Territory and the State of Victoria.

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TABLE 2
AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities[1,2,3]	Annual capacity[e]
Alumina	Queensland Alumina Ltd., operator [Rio Tinto Ltd., 30.3%; Kaiser Aluminum and Chemical Corp. (Australia) Ltd., 28.3%; Alcan South Pacific Pty. Ltd., 21.4%; Pechiney Australia Pty. Ltd., 20%]	Gladstone alumina refinery, QLD	3,800
Do.	Alcan Northern Territory Pty. Ltd., 70%, and Alcan South Pacific Pty. Ltd., 30%	Gove alumina refinery, NT	1,900
Do.	Alcoa World Alumina Australia, 100%	Kwinana alumina refinery, WA	2,100
Do.	do.	Pinjarra alumina refinery, WA	3,400
Do.	Alcoa World Alumina Australia, 60%, and Western Mining Corp., 40%	Wagerup alumina refinery near Waroona, WA	2,200
Do.	Worsley Alumina Pty. Ltd., manager [BHP Billiton Ltd., 86%, and Japan Alumina Associates (Australia) Pty Ltd., 10%]	Worsley alumina refinery, 20 km NW of Collie, WA	3,200
Aluminum	Comalco Aluminium (Bell Bay) Ltd., 100%	Bell Bay aluminum smelter, TAS	142
Do.	VAW Kurri Kurri Pty. Ltd., 100%	Kurri Kurri aluminum smelter, NSW	150
Do.	Boyne Smelters Ltd., operator (Rio Tinto Ltd., 64%; Sumitomo Light Metal Industries Ltd., 17%; Ryowa Development Pty. Ltd., 12%, Kobe Steel Ltd., 5%; Sumitomo Chemical Co. Ltd., 2%)	Boyne Island aluminum smelter, QLD	490
Do.	Alcoa of Australia, 100%	Point Henry aluminum smelter, VIC	185
Do.	Alcoa of Australia, 45% and manager; China International Trust Investment Co. (a Chinese Government agency), 2.5%; Marubeni Australia Pty. Ltd., 22.5%; Eastern Aluminum Ltd., 10%	Portland aluminum smelter, VIC	345
Do.	Tomago Aluminium Co. Pty. Ltd., operator (Gove Aluminium Finance Ltd., 36%; Pechiney Australia Pty. Ltd., 36%; Australian Mutual Provident Society, 16%; VAW Australia Pty. Ltd., 12%)	Tomago aluminum smelter, NSW	444
Antimony	New England Antimony Mines NL, 100%	Hillgrove underground antimony-gold mine, 25 km E of Armidale, NSW	4
Bauxite	Alcan Inc., 100%	Gove open pit bauxite mine, Gove Peninsula, NT	7,000
Do.	Alcoa World Alumina Australia, 100%	Huntly open pit bauxite mine, 80 km S of Perth, WA	20,000
Do.	Comalco Ltd., operator (Rio Tinto plc, 100%)	Weipa-Andoom open pit bauxite mine, Weipa, QLD	12,000
Do.	do.	Willowdale open pit bauxite mine, 130 km S of Perth, WA	8,600
Do.	Worsley Alumina Pty. Ltd., manager [BHP Billiton Ltd., 86%; Kobe Alumina Associates (Australia) Pty. Ltd., 10%; Nissho Iwai Alumina Pty. Ltd., 4%]	Worsley open pit bauxite mine, 50 km NE of Collie, WA	11,000
Bentonite	Arumpo Bentonite Pty. Ltd., 100%	Arumpo open pit bentonite mine, 95 km NE of Mildura, NSW	10
Do.	Unimin Australia Ltd., 100%	Cressfield open pit bentonite mine, 20 km N of Scone, NSW	12
Do.	do.	Miles open pit bentonite mine, 350 km W of Brisbane, QLD	100
Cement	Blue Circle Southern Cement Ltd., 100%	Berrima Cement Plant, NSW	1,200
Do.	Adelaide Brighton Cement Ltd., 100%	Birkenhead Cement Plant, SA	1,000
Do.	Queensland Cement Ltd., 100%	Darra Cement Plant, QLD	700
Do.	Adelaide Brighton Cement Ltd., 100%	Geelong Cement Plant, VIC	800
Do.	Goliath Cement Holdings Ltd., 100%	Railton Cement Plant, TAS	1,000
Do.	Cockburn Cement Ltd., 100%	South Coogee Cement Plant, WA	1,000
Chromite	Sylvania Resources Ltd., 100%	Coobina open pit chromite mine, 56 km ESE of Newman, WA	100
Coal, black	Powercoal Pty. Ltd., 100%	Angus Place longwall coal mine, 16 km NW of Lithgow, NSW	2,200

See footnotes at end of table.

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TABLE 2--Continued
AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities[1,2,3]	Annual capacity[e]
Coal, black--Continued:	BHP Steel (AIS) Pty. Ltd., 100%	Appin longwall coal mine, 40 NW of Wollongong, NSW	3,300
Do.	Powercoal Pty. Ltd., 100%	Awaba underground coal mine, 30 km SW of Newcastle, NSW	2,000
Do.	Oakbridge Pty. Ltd., 95%, and Sumitomo Corp., 5%	Baal Bone longwall coal mine, 24 km NW of Lithgow, NSW	3,500
Do.	BHP Billiton Hunter Valley Energy Coal, 100%	Bayswater open pit coal mine, 33 km NW of Singleton, 13 km SSW of Muswellbrok, NSW	5,500
Do.	Coal and Allied Industries Ltd., 40% and manager (Wesfarmers Bengalla Ltd., 40%; MCDA Bengalla Investment Pty. Ltd., 10%; Taipower Bengalla Pty. Ltd., 10%)	Bengalla open pit coal mine, 5 km W of Muswellbrook, NSW	5,000
Do.	Berrima Coal Pty. Ltd., 100%	Berrima underground coal mine, 60 km NE of Goulburn, NSW	2,000
Do.	BHP Billiton Mitsubishi Alliance, manager (BHP Billiton Ltd., 50%, and Mitsubishi Development Pty. Ltd., 50%)	Blackwater open pit coal mine (includes South Blackwater), 195 km W of Rockhamton, QLD	13,500
Do.	Xstrata Coal Australia Pty. Ltd., manager (Oakbridge Pty. Ltd., 87.5%, and Nippon Steel Australia Pty. Ltd., 12.5%)	Bulga open pit/longwall coal mine, 16 km SW of Singleton, NSW	11,000
Do.	Pacific Coal Pty. Ltd., 57.195% and manager [Leichhardt Coal Pty. Ltd., 31.419%; EPDC (Australia) Pty. Ltd., 7.9723%; and Japan Coal Development Co. Ltd., 3.416%]	Blair Athol open pit coal mine, 110 km NW of Emerald, 25 km NW of Clermont, QLD	11,000
Do.	Bloomfield Collieries Pty. Ltd., 100%	Bloomfield open pit coal mine, 20 km NW of Newcastle, 5 km SE of Maitland, NSW	1,300
Do.	Anglo Coal Holdings Australia Ltd., 100%	Boundary Hill open pit coal mine (includes Callide), 115 km to 140 km W of Gladstone, QLD	7,250
Do.	RAG Australia Pty. Ltd., manager (Burton Coal Pty. Ltd., 95%, and Thiess Pty. Ltd., 5%)	Burton open pit coal mine, 150 km SW of Mackay, QLD	5,800
Do.	Camberwell Coal Pty. Ltd., manager [Toyota Tsusho Mining (Australia) Pty. Ltd., 90%, and Dia Coal Mining (Australia) Pty. Ltd., 10%]	Camberwell open pit coal mine, 10 km NW of Singleton, NSW	4,000
Do.	LakeCoal Pty. Ltd., 80%, manager; Catherine Hill Resources Pty. Ltd., 20%	Chain Valley underground coal mine, 48 km S of Newcastle, NSW	3,000
Do.	Centennial Coal Co. Ltd., 85%, manager; SK Australia Pty. Ltd., 15%	Clarence underground coal mine, 10 km E of Lithgow, NSW	2,200
Do.	Roche Mining Pty. Ltd., operator (Millmerran Power Partners, 100%)	Commodore open pit coal mine, 80 km S of Toowoomba, QLD	3,600
Do.	Xstrata Coal Australia Pty. Ltd., 50%; Centennial Coal Co. Ltd., 45%; Tokyo Boeki Ltd., 5%	Cook underground coal mine, near Blackwater, QLD	1,000
Do.	Powercoal Pty. Ltd., 100%, manager	Cooranbong underground coal mine, 35 km SW of Newcastle, NSW	1,600
Do.	Australian Premium Coals Pty. Ltd., manager (Macarthur Coal Ltd., 45%; QCR No. 2 Pty. Ltd., 20%; CPB Coals Pty., 10%; Marubeni Coal Pty. Ltd., 7.5%; Nissho Iwai Australia Ltd., 7.5%; Citic Australia Coal Ltd., 5%; Kawasho Group, 3%; Nittetsu Shoji, 2%)	Coppabella open pit coal mine, 150 km SW of Mackay, QLD	4,700
Do.	BHP Billiton Mitsubishi Alliance, manager (BHP Billiton Ltd., 50%, and Mitsubishi Development Pty. Ltd., 50%)	Crinum longwall coal mine, 45 km NE of Emerald, QLD	4,000
Do.	Cumnock No. 1 Colliery Pty. Ltd., 100%	Cumnock No. 1 open pit/longwall coal mine, 28 km NW of Singleton, NSW	2,750
Do.	Curragh Queensland Mining Ltd., 100%	Curragh open pit coal mine, 70 km E of Emerald, QLD	5,000
Do.	Anglo Coal Holdings Australia Ltd., 93%, and Ssangyong Resources Ltd., 7%	Dartbrook longwall coal mine, 70 km N of Singleton, NSW	3,750
Do.	BHP Billiton Ltd., 100%	Dendrobium longwall coal mine, 15 km SW of Wollongong, NSW	5,200

See footnotes at end of table.

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TABLE 2--Continued
AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities[1,2,3]	Annual capacity[e]
Coal, black--Continued:	Anglo Coal Holdings Australia Ltd., 88.2% and manager; Mitsui Coal Development Australia Pty. Ltd., 3.8%; Mitsui Mining (Australia) Pty. Ltd., 3%; Daesung Australia Pty. Ltd., 2.5%; and Hyundai (Australia) Pty. Ltd., 2.5%	Drayton open pit coal mine, 35 km NW of Singleton, NSW	5,000
Do.	Ebenezer Mining Co., 100%	Ebenezer open pit coal mine, 40 km SW of Brisbane, QLD	1,500
Do.	BHP Steel (AIS) Pty. Ltd.	Elouera longwall coal mine, 15 km SW of Wollongong, NSW	2,000
Do.	Idemitsu Kosan Co. Ltd., 85%; EPDC (Australia) Pty. Ltd., 10%; LG International (Australia) Pty. Ltd., 5%	Ensham-Yongala open pit coal mine, 40 km NE of Emerald, QLD	5,500
Do.	Griffin Coal Mining Co. Pty. Ltd., 100%	Ewington II open pit coal mine, 8 km E of Collie, WA	1,000
Do.	CAML Resources Pty. Ltd., 63%; Itochu Corp., 20.6%; Bowen Basin Investments Pty. Ltd., 16.4%	Foxleigh open pit coal mine, Bowen Basin, QLD	2,300
Do.	Anglo Coal Holdings Australia Ltd., 100% of German Creek and 75.04% of German Creek East; Marubeni Coal Pty. Ltd., 24.96% of German Creek East	German Creek and German Creek East open pit/longwall coal mines, 275 km WNW of Rockhampton, QLD	6,000
Do.	Console Energy Inc., 50% and Namoi Hunter Pty. Ltd., 50%	Glennies Creek longwall coal mine, 12 km N of Singleton, NSW	2,500
Do.	BHP Billiton Ltd., 80% at Riverside and 50% at Goonyella; Mitsubishi Corp., 50% at Goonyella; BHP Mitsui Coal Pty. Ltd., 20% at Riverside	Goonyella-Riverside open pit coal mines, 140 km SW of Mackay, QLD	11,000
Do.	BHP Billiton Mitsubishi Alliance, manager (BHP Billiton Ltd., 50%, and Mitsubishi Development Pty. Ltd., 50%)	Gregory open pit coal mine, 60 km N of Emerald, QLD	5,500
Do.	Coal and Allied Industries Ltd., 100%, manager	Hunter Valley Operations (includes Carrington Chestnut, Howick, Hunter Valley No. 1, Lemington, Riverview open pit coal mines), 10 km W to 25 km N of Singleton, NSW	15,000
Do.	New Hope Corp. Ltd., 100%	Jeebropilly open pit coal mine, 35 km SW of Brisbane, QLD	1,500
Do.	Queensland Coal Mine Management Pty. Ltd., 70%; Winnin Pty. Ltd., 15%; Marubeni Coal Pty. Ltd., 15%	Jellinbah East open pit coal mine, 90 km E of Emerald, QLD	3,000
Do.	Pacific Coal Pty. Ltd., 80%, and Kestrel Coal Investment Pty. Ltd., 20%	Kestrel longwall coal mine, 40 km NNE of Emerald, QLD	3,300
Do.	Xstrata Coal Australia Pty. Ltd., 67%, and Mitsui Matushima Australia Pty. Ltd., 32.5%	Liddell open pit coal mine, 25 km NW of Singleton, NSW	4,000
Do.	Burragorang Valley Coal Pty. Ltd., 100%	Metropolitan longwall coal mine, 30 km N of Wollongong, NSW	1,400
Do.	LakeCoal Pty. Ltd., 80%, and Catherine Hill Resources Pty. Ltd., 20%	Moonee longwall coal mine, 37 km S of Newcastle, NSW	1,200
Do.	Anglo Coal Holdings Australia Ltd., 88%; Nippon Steel Australia Pty. Ltd., 5%; Tomen Coal Resources Pty. Ltd., 3.75%; private interests, 3.25%	Moranbah North longwall coal mine, 150 km SW of Mackay, QLD	5,700
Do.	Hunter Valley Coal Corp., 100%	Mount Owen open pit coal mine, 20 km NW of Singleton, near Ravensworth, NSW	8,000
Do.	Coal and Allied Industries Ltd., 80%, and Pohang Steel Australia Pty. Ltd., 20%	Mount Thorley open pit coal mine, 14 km SW of Singleton, NSW	6,500
Do.	Mitsui & Co. (Australia) Ltd., 100%	Moura open pit coal mine, 185 km W of Gladstone, QLD	4,400
Do.	The Griffin Coal Mining Co. Pty. Ltd., 100%	Muja open pit coal mine, 18 km SE of Collie, WA	2,000
Do.	Powercoal Pty. Ltd., 100%	Munmorah underground coal mine, 55 km S of Newcastle, NSW	7,000
Do.	Muswellbrook Coal Co., 100%	Muswellbrook No. 2 open pit coal mine, 4 km NE of Muswellbrook, Hunter Valley NSW	1,700
Do.	Powercoal Pty. Ltd., 100%	Myuna underground coal mine, 35 km S of Newcastle, NSW	1,500

See footnotes at end of table.

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TABLE 2--Continued
AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities[1,2,3]	Annual capacity[e]
Coal, black--Continued:	Nardell Coal Corp., 100%	Nardell underground coal mine, 18 km NW of Singleton, NSW	1,200
Do.	MIM Holdings Ltd., manager (Collinsville Coal Co. Pty. Ltd., 75%, and Itochu Coal Resources Australia Pty. Ltd., 25%)	Newlands-Collinsville-Abbot Point open pit/longwall coal mine, 130 km west of Mackay, QLD	7,000
Do.	Powercoal Pty. Ltd., 100%, manager	Newstan longwall coal mine, 30 km SW of Newcastle, NSW	2,700
Do.	Rag Coal International AG, 40%, and Thiess Pty. Ltd., 40%	North Goonyella longwall coal mine, 180 km W of Mackay, QLD	3,000
Do.	BHP Billiton Ltd., 50%, and Mitsubishi Corp., 50%	Norwich Park open pit coal mine, 85 km NNE of Emerald, QLD	4,000
Do.	Oaky Creek Coal Pty. Ltd., 75%; Sumitomo Coal Australia Pty. Ltd., 15%; Itocho Coal Resources Australia Pty. Ltd., 10%, of Oaky Creek; Namoi Highwall Pty. Ltd., 50%, and Sumitomo Coal Australia Pty. Ltd., 50%, of Alliance	Oaky Creek longwall and Alliance open pit coal mines, 300 km WNW of Rockhampton, QLD	9,500
Do.	BHP Billiton Ltd., 50%, and Mitsubishi Development Pty. Ltd., 50%	Peak Downs open pit coal mine, 145 km N of Emerald, QLD	7,500
Do.	Wesfarmers Premier Coal Ltd., 100%	Premier open pit coal mine, 10 km SE of Collie, WA	4,000
Do.	Xstrata Coal Australia Pty. Ltd., 100% of Ravensworth and 50% at Narama; Iluka Resources Ltd., 50% at Narama	Ravensworth-Narama open pit coal mine (includes Ravensworth East), at Lemington, 20 km NW of Singleton, NSW	6,200
Do.	Bloomfield Colliers Pty. Ltd., 100%	Rixs Creek open pit coal mine, 5 km NW of Singleton, NSW	2,000
Do.	BHP Mitsui Coal Pty. Ltd., 100%	South Walker Creek open pit/ underground coal mine, 90 km SW of Mackay, 20 km W of Nebo, QLD	3,500
Do.	BHP Billiton Ltd., 50%, and Mitsubishi Development Pty. Ltd., 50%	Saraji open pit coal mine, 125 km N of Emerald, QLD	5,000
Do.	Southland Coal Pty. Ltd., 90%, and Thiess Pty. Ltd., 10%	Southland longwall coal mine, 40 km W of Newcastle, NSW	2,000
Do.	G.C. Springvale Pty. Ltd., 50%, and Samsung Development (Australia) Pty. Ltd., 50%	Springvale longwall coal mine, 16 km NW of Lithgow, NSW	2,000
Do.	Austral Coal Ltd., 100%	Tahmoor longwall coal mine (includes Tahmoor North and Bargo), near Picton, about 70 km SW of Sydney, NSW	2,000
Do.	Pacific Coal Pty. Ltd., 100%	Tarong-Meandu open pit coal mine, 85 km N of Toowoomba, QLD	5,500
Do.	BHP Steel (AIS) Pty. Ltd., 100%	Tower longwall coal mine, 32 km NW of Wollongong, NSW	2,000
Do.	Ulan Coal Mines Ltd., 10%, and Mitsubishi Development Pty. Ltd., 10%	Ulan open pit/longwall coal mine, 45 km NW of Mudgee, NSW	12,000
Do.	Xstrata Coal Australia Pty. Ltd., 95%, and United Mine Workers, 5%	United Collieries underground coal mine, 15 km W of Singleton, NSW	1,600
Do.	Wambo Coal Pty. Ltd., 100%	Wambo longwall coal mine, 15 km W of Singleton, NSW	3,100
Do.	Coal and Allied Industries, Ltd., 55.574%; Mitsubishi Coal Development Pty. Ltd., 28.898%; Nippon Steel Australia Pty. Ltd., 9.528%; Mitsubishi Corp., 6%	Warkworth open pit coal mine, 11 km SW of Singleton, NSW	6,400
Do.	BHP Steel (AIS) Pty. Ltd., 100%	West Cliff longwall coal mine, 43 km NW of Wollongong, NSW	3,000
Do.	Oceanic Coal Australia Ltd., 70%; Marubeni Coal Pty. Ltd., 17%; Ocal Macquarie Pty. Ltd., 10%; Kokan Kogyo (Australia) Pty. Ltd., 3%	West Wallsend longwall coal mine, 25 km SW of Newcastle, NSW	3,000
Do.	Powercoal Pty. Ltd., 100%	Wyee longwall coal mine, 40 km S of Newcastle, NSW	1,200

See footnotes at end of table.

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TABLE 2--Continued
AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities[1,2,3]	Annual capacity[e]
Coal, brown	Alcoa World Alumina Australia, 100%	Anglesea open pit lignite mine, 97 km SW of Melbourne, near Geelong, VIC	1,200
Do.	Hazelwood Power, 100%	Hazelwood open pit lignite mine at Morwell, 150 km SE of Melbourne, VIC	19,500
Do.	Loy Yang Power Ltd., 100%	Loy Yang open pit lignite mine at Traralgon, 165 km E of Melbourne, VIC	32,000
Do.	Auspower Pty. Ltd., 73.6%; Powergen Plc., 18.4%; Deutsche Asset Management, 8%	Yallourn open pit lignite mine, 140 km SE of Melbourne, VIC	18,500
Cobalt	Preston Resources Ltd., 100%	Bulong open pit nickel-cobalt mine, 30 km E of Kalgoorlie, WA	0.1
Do.	OM Group Inc., 100%	Cawse open pit nickel-cobalt mine, 50 km NW of Kalgoorlie, WA	0.2
Do.	Anaconda Nickel Ltd., 60%, manager; Glencore Australia Pty. Ltd. International AG, 40%	Murrin Murrin open pit nickel-cobalt mine, 60 km E of Leonora, WA	0.1
Do.	Australian Nickel Mines NL, 100%	Radio Hill underground nickel-cobalt mine, 100 km ESE of Karratha, WA	0.2
Do.	QNI Pty. Ltd., 100%	Yabulu nickel-cobalt refinery, Townsville, QLD	2
Copper	Newcrest Mining Ltd., 100%	Cadia Hill open pit gold-copper mine, 21 km SSW of Orange, NSW	25
Do.	Glencore Australia Pty. Ltd., 100%	Cobar underground copper mine, 10 km NW of Cobar, NSW	30
Do.	Amalg Resources NL, 100%	Eloise underground copper mine, 60 km SE of Cloncurry, QLD	70
Do.	MIM Holdings Ltd., 51%, and Westpac Banking Corp., 49%	Ernest Henry open pit copper-gold mine, 35 km NE of Cloncurry, QLD	105
Do.	Murchison Zinc Co. Pty. Ltd., 100%	Golden Grove underground zinc-copper mine (includes Gossan Hill and Scuddles), 225 km E of Geraldton, WA	6
Do.	Thalanga Copper Mines Pty. Ltd., 70%, and BML Holdings Pty. Ltd., 30%	Highway-Reward open pit and underground copper mine, 37 km S of Charters Towers	185
Do.	Western Metals Ltd., 100%	Hellyer underground zinc-lead-copper-silver mine, 80 km SSW of Burnie, TAS	1
Do.	Copper Refineries Pty. Ltd., operator (MIM Holdings Ltd., 100%)	MIM copper refinery, Townsville, QLD	270
Do.	MIM Holdings Ltd., 100%	MIM copper smelter, QLD	250
Do.	Matrix Metals Ltd., 100%	Mount Pithbert open pit mine (includes Mount Watson), 90 km NW of Cloncurry, QLD	8
Do.	Western Metals Ltd., 100%	Mount Gordon open pit copper mine (includes Esperanza and Mammoth), 125 kilometers N of Mount Isa	46
Do.	MIM Holdings Ltd., 100%	Mount Isa underground copper-lead-zinc-silver mine (also includes Enterprise, George Fisher, and Hilton mines) at Mount Isa, QLD	275
Do.	Copper Mines of Tasmania Pty. Ltd., 100%	Mount Lyell underground copper-gold mine, 2 km NE of Queenstown, TAS	35
Do.	Straits (Nifty) Pty. Ltd., 100%	Nifty open pit copper mine, 200 km SE of Marble Bar, WA	22
Do.	Rio Tinto Ltd., 80%; Sumitomo Metal Mining Oceania Pty. Ltd., 13.3%; SC Mineral Resources Pty. Ltd., 6.7%	Northparkes open pit/underground copper-gold mine, 27 km N of Parkes, NSW	55
Do.	WMC Olympic Dam Operations Pty. Ltd., 100%	Olympic Dam underground copper-silver-gold-uranium mine at Roxby Downs, 80 km N of Woomera, SA	220
Do.	do.	Olympic Dam copper refinery, SA	220
Do.	do.	Olympic Dam copper smelter, SA	70

See footnotes at end of table.

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TABLE 2--Continued
AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities[1,2,3]	Annual capacity[e]
Copper--Continued:		Placer Dome Asia Pacific Ltd., 100%	Osborne underground copper-gold mine, 195 km SE of Mount Isa, QLD	50
Do.		Peak Gold Mines Pty. Ltd., 100%	Peak underground gold-zinc-lead-copper-silver underground mine (includes New Cobar, New Occidental, and Perseverance), 8 km S of Cobar, NSW	3
Do.		Furukawa Co. Ltd., 52.5%; Nittetsu Mining Co., 20%; Nissho Iwai Corp., 17.5%; Itochu Corp., 10%	Port Kembla copper refinery, NSW	120
Do.		do.	Port Kembla copper smelter, NSW	120
Do.		Newcrest Mining Ltd., 100%	Ridgeway underground gold-copper mine, 25 km S of Orange, NSW	30
Do.		Pasminco Ltd., 100%	Rosebery underground zinc-lead-silver-copper-gold mine, 35 km N of Queenstown, TAS	1
Do.		Selwyn Mines Ltd., 100%	Selwyn underground copper-gold mine, 150 km SE of Mount Isa, QLD	17
Diamond	thousand carats	Rio Tinto plc., 100%	Argyle Mine (AK-1 lamproite pipe and alluvial diamond mines), 120 km SW of Kununurra, WA	26,000
Do.	do.	do.	Merlin open pit diamond mine, 80 km S of Borroloola, NT	55
Diatomite		Australian Diatomite Mining Pty. Ltd., 100%	Barraba open pit diatomite mine, 85 km NNW of Tamworth, NSW	25
Dolomite		OneSteel Ltd., 100%	Ardrossan metallurgical dolomite quarry, Northern York Peninsula, SA	650
Feldspar		Minerals Corp. Ltd., 100%	Triple Chance open pit feldspar mine (includes Lady Beryl, Bakers, and Spar Ridge), 42 km SW of Broken Hill, NSW	15
Garnet		GMA Garnet Pty. Ltd., 100%	Port Gregory open pit industrial garnet mine, 100 km N of Geraldton, WA	200
Gas:				
Condensate	thousand 42-gallon barrels per day	Woodside Petroleum Pty. Ltd., manager [BHP Petroleum Pty. Ltd., BP Australia Holdings Ltd., Chevron Asiatic Ltd., Japan Australia LNG (MIMI) Pty. Ltd., Shell Development (Australia) Pty. Ltd., and Woodside Petroleum Ltd., 16.67% each]	North West Shelf gas operations, 130 km offshore from Dampier, WA	60
Natural	million cubic meters per day	Woodside Petroleum Pty. Ltd., manager [BHP Petroleum Pty. Ltd., BP Australia Holdings Ltd., Chevron Asiatic Ltd., Japan Australia LNG (MIMI) Pty. Ltd., Shell Development (Australia) Pty. Ltd., and Woodside Petroleum Ltd., 16.67% each]	North West Shelf gas operations, 130 km offshore from Dampier, WA	20
Liquefied natural	million metric tons	do.	Three-train liquefaction plant, Burrup Peninsula, WA	8
Gold	kilograms	Gold Fields Ltd. (South Africa), 100%	Agnew open pit/underground gold mine, 23 km W of Leinster, WA	5,600
Do.	do.	New Hampton Goldfields Ltd., 100%	Big Bell Consolidated open pit/underground gold mine (includes Big Bell, Black Swan, Cuddingwarra, Great Fingall, Golden Crown, and Tuckabianna): Big Bell, 30 km WNW of Cue; Cuddingwarra, 10 km WNW of Cue; Golden Crown, 7 km S of Cue, WA	7,000
Do.	do.	Worsley Alumina Pty. Ltd., operator (Newmont Mining Corp., 44.45%; AngloGold Ltd., 33.33%; Newcrest Mining Ltd., 22.22%)	Boddington open pit/underground gold mine (includes Wandoo and Hedges), 150 km SE of Perth, WA[4]	12,000
Do.	do.	Normandy Yandal Operations Ltd., 100%	Bronzewing underground gold mine (includes Mount McClure), 65 km NE of Leinster, WA	9,000
Do.	do.	Newcrest Mining Ltd., 100%	Cadia Hill open pit gold-copper mine, 21 km SSW of Orange, NSW	11,000

See footnotes at end of table.

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TABLE 2--Continued
AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities[1,2,3]	Annual capacity[e]
Gold--Continued:	kilograms	MIM Holdings Ltd., 51%, and Westpac Banking Corp., 49%	Ernest Henry open pit copper-gold mine, 35 km NE of Cloncurry, QLD	3,000
Do.	do.	Kalgoorlie Consolidated Gold Mines Pty. Ltd., 100%	Gidji Roaster gold smelter, Kalgoorlie, WA	24,300
Do.	do.	Normandy NFM Ltd., 100%	Granites-Dead Bullock Soak open pit/ underground gold mine, 550 km NW of Alice Springs, in the Tanami Desert, NT	7,000
Do.	do.	Placer Dome Asia Pacific Ltd., manager (Placer Dome Inc., 60%, and Delta Gold Ltd., 40%)	Granny Smith open pit gold mine (includes Sunrise and Wallaby), 20 km S of Laverton, WA	16,000
Do.	do.	AuIronGold Ltd., 100%	Henty underground gold-silver mine, 30 km N of Queenstown, TAS	3,700
Do.	do.	Thalanga Copper Mines Pty. Ltd., 70%, and BML Holdings Pty. Ltd., 30%	Highway-Reward open pit and underground copper mine, 37 km S of Charters Towers, QLD	1,000
Do.	do.	New England Antimony Mines NL, 100%	Hillgrove underground antimony-gold mine, 25 km E of Armidale, NSW	1,000
Do.	do.	Newmont Yandal Operations Ltd., 100%	Jundee-Nimary open pit/underground gold mine, 45 km NE of Wiluna, WA	12,000
Do.	do.	AuIronGold Ltd., 100%	Kanowna Belle underground gold mine, 18 km NE of Kalgoorlie, WA	7,000
Do.	do.	Barrack Gold Corp., 100%	Lawlers underground gold mine, 30 km SW of Leinster, WA	3,000
Do.	do.	Sons of Gwalia Ltd., 100%	Marvel Loch Operations open pit/ underground gold mines approximately 30 km SE of Southern Cross, WA	10,000
Do.	do.	Saint Barbara Mines Ltd., 100%	Meekatharra open pit/underground gold mine, 20 km S of Meekatharra, WA	4,000
Do.	do.	Copper Mines of Tasmania Pty. Ltd., 100%	Mount Lyell underground copper-gold mine, 2 km NE of Queenstown, TAS	1,000
Do.	do.	Harmony Gold Mining Co. Ltd., 100%	Mount Magnet open pit/underground gold mine (includes Hill 50 and Star), 2 km from Mount Magnet, WA	8,500
Do.	do.	Australian Gold Refineries, 100% (State of WA agency)	Newburn gold refinery, WA	246,000
Do.	do.	Croesus Mining NL, 100%	Norseman underground gold mine at Norseman, WA	3,700
Do.	do.	Rio Tinto Ltd., 80%; Sumitomo Metal Mining Oceania Pty. Ltd., 13.3%; SC Mineral Resources Pty. Ltd., 6.7%	Northparkes open pit/underground copper-gold mine, 27 km N of Parkes, NSW	155,000
Do.	do.	Placer Dome Asia Pacific Ltd., 100%	Osborne underground copper-gold mine,	1,500
Do.	do.	WMC Olympic Dam Operations Pty. Ltd., 100%	Olympic Dam underground copper-silver-gold-uranium mine at Roxby Downs, 80 km N of Woomera, SA	1,500
Do.	do.	MIM Holdings Ltd., 100%	Pacific precious metals refinery, NSW	1,900
Do.	do.	Paddington Gold Pty. Ltd., 100%	Paddington open pit gold-silver mine, 35 km NW of Kalgoorlie, WA	2,800
Do.	do.	Newmont Pajingo Pty. Ltd., 100%	Pajingo underground gold mine (includes Vera-Nancy), 60 km SSE of Charters Towers, QLD	6,400
Do.	do.	Peak Gold Mines Pty. Ltd., 100%	Peak underground gold-zinc-lead-copper-silver underground mine (includes New Cobar, New Occidental, and Perseverance), 8 km S of Cobar, NSW	350,000
Do.	do.	Alkane Exploration Ltd., 100%	Peak Hill open pit gold mine, 50 km N of Parkes, NSW	700,000
Do.	do.	Australian Gold Refineries, 100% (State of WA agency)	Perth Refinery (Newburn), WA	95,000
Do.	do.	Homestake Mining Co., 100%	Plutonic open pit/underground gold mine, (includes Freshwater), 180 km NE of Meekatharra, WA	8,000

See footnotes at end of table.

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TABLE 2--Continued
AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities[1,2,3]	Annual capacity[e]
Gold--Continued:	kilograms	Carpentaria Gold Pty. Ltd., 50.1%, and Haoma Mining NL, 49.9%	Ravenswood open pit mine (includes Nolans, Sarsfield, and Mount Wright), 100 km S of Townsville, QLD	3,000
Do.	do.	Newcrest Mining Ltd., 100%	Ridgeway underground gold-copper mine, 25 km S of Orange, NSW	10,800
Do.	do.	Pasminco Ltd., 100%	Rosebery underground zinc-lead-silver-copper-gold mine, 35 km N of Queenstown, TAS	1,000
Do.	do.	Gold Fields Ltd., 100%	Saint Ives open pit/underground gold mine, 75 km SSE of Kalgoorlie, WA	15,000
Do.	do.	Selwyn Mines Ltd., 100%	Selwyn underground copper-gold mine, 150 km SE of Mount Isa, QLD	700
Do.	do.	Sons of Gwalia Ltd., 100%	Sons of Gwalia open pit/underground gold mine (includes Red October, Harlech, McGraths, Kailis, and Anchor), 5 km W of Leonora, WA	6,000
Do.	do.	MPI Gold Pty. Ltd., 50%, and Pittston Mineral Ventures of Australia Pty. Ltd., 50%	Stawell underground gold mine, 240 km W of Melbourne, VIC	3,000
Do.	do.	AngloGold Ltd., 100%	Sunrise Dam open pit mine gold (includes Cleo), 55 km S of Laverton, WA	8,000
Do.	do.	Kalgoorlie Consolidated Gold Mines Pty. Ltd., manager (Barrick Gold Corp., 50%, and Newmont Mining Ltd., 50%)	Super Pit open pit gold mine (includes Fimiston), SE corner of the Kalgoorlie-Boulder Township, WA	20,000
Do.	do.	Otter Gold Mines Ltd., 60%, and AngloGold Ltd., 40%	Tanami open pit gold mine (includes Central Desert Joint Venture), 650 km NW of Alice Springs, NT	2,800
Do.	do.	PacMin Mining Corp., 100%	Tarmoola open pit gold mine, 29 km NW of Leonora, WA	6,500
Do.	do.	AngloGold Ltd., 100%	Union Reefs open pit gold mine, 12 km N of Pine Creek, NT	3,000
Do.	do.	Wiluna Mines Ltd., 100%	Wiluna open pit/underground gold mine, 7 km S of Wiluna, WA	3,300
Gypsum		Gypsum Resources Australia Pty. Ltd., 100%	Lake MacDonnell open pit gypsum mine, near Point Thevenard, SA	1,400
Do.		Dampier Salt Ltd., 100%	Lake MacLeod salt and gypsum solar evaporation ponds, 65 km N of Carnarvon, WA	900
Iron ore		Hamersley Iron Pty. Ltd., 60%, and China Iron and Steel Industry & Trade Group Corp. (a Chinese Government agency), 40%	Channar open pit iron ore mine, 70 km S of Tom Price, WA	11,000
Do.		BHP Billiton Ltd., 100%	Cockatoo Island open pit iron ore mine, 130 km NNE of Derby, WA	1,050
Do.		Hamersley Iron Pty. Ltd., 100%	Hamersley Operations (includes Brockman No. 2, Marandoo, Mount Tom Price, Nammuldi, Paraburdoo, and Yandicoogina open pit iron ore mines), 30 km to 85 km NE, NW, and S of Tom Price, WA	60,000
Do.		BHP Minerals Pty. Ltd., 100%	Jimblebar open pit iron ore mine, 40 km E of Newman, WA	6,000
Do.		Portman Ltd., 100%	Koolyanobbing Central open pit iron ore mine, 50 km NNE of Southern Cross, WA	3,000
Do.		BHP Iron Ore Pty. Ltd., 85%, manager; CI Minerals Australia Pty. Ltd., 8%; Mitsui Iron Ore Corp. Pty. Ltd., 7%	Mount Goldsworthy open pit iron ore mine (includes Yarrie), 180 km E of Port Hedland, WA	8,000
Do.		Imdex Ltd., 100%	Mount Gould open pit iron ore mine, 160 km W of Meekatharra, WA	6,000

See footnotes at end of table.

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TABLE 2--Continued
AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities[1,2,3]	Annual capacity[e]
Iron ore--Continued	BHP Iron Ore Pty. Ltd., 85%; Mitsui Itochu Iron Pty. Ltd., 10%; CI Minerals Australia Pty. Ltd., 5%	Mount Newman (includes Mount Whaleback, Orebody 23-25, Orebody 29, and Orebody 30-35) open pit iron ore mines, within 13 km of Newman, WA	25,000
Do.	Robe River Iron Associates, manager (Rio Tinto Ltd., 53%; Mitsui & Co. (Australia), Ltd., 33%; Nippon Steel Australia Pty. Ltd., 10.5%; Sumitomo Metal Australia Pty. Ltd., 3.5%)	Pannawonica (includes Mesa J) open pit iron ore mine, 130 km SSW of Dampier WA	31,000
Do.	ABM Mining Ltd., 100%	Savage River open pit iron ore mine (includes Long Plains), 100 km SW of Burnie, TAS	2,400
Do.	OneSteel Ltd., 100%	Whyalla open pit iron ore mines, 270 km NW of Adelaide, SA	2,600
Do.	BHP Minerals Pty. Ltd., 55%; Pilbara Iron Pty. Ltd., 30%; CI Minerals Australia Pty. Ltd., 8%; Mitsui Iron Ore Corp. Pty. Ltd., 7%	Yandi open pit iron ore mine, 92 km N of Newman, WA	35,000
Kaolin	Osterfield Pty. Ltd., 100%	Axedale Clays open pit kaolin mine, 18 km E of Bendigo, VIC	50
Do.	Queensland Kaolin Pty. Ltd., 96.6%, and private interests, 3.4%	Skardon River open pit kaolin mine, 85 km N of Weipa, QLD	150
Lead	Perilya Ltd., 100%	Broken Hill underground silver-zinc-lead mine at Broken Hill, NSW	90
Do.	BHP Minerals Ltd., 100%	Cannington underground silver-lead-zinc mine, 200 km SE of Mount Isa, QLD	265
Do.	Pasminco Century Mine Ltd., 100%	Century open pit zinc-silver-lead mine, 250 km NW of Mount Isa, QLD	70
Do.	Pasminco Ltd., 100%	Cockle Creek lead smelter, NSW	35
Do.	do.	Elura underground zinc-silver-lead mine, 40 km NW of Cobar, NSW	45
Do.	Western Metals Ltd., 100%	Hellyer underground zinc-lead-copper-silver mine, 80 km SSW of Burnie, TAS	44
Do.	do.	MIM lead smelter, QLD	160
Do.	MIM Holdings Ltd., 100%	Mount Isa underground copper-lead-zinc-silver mine (also includes enterprise, George Fisher, and Hilton mines) at Mount Isa, QLD	150
Do.	do.	Mount Isa Smelter, QLD	240
Do.	Peak Gold Mines Pty. Ltd., 100%	Peak underground gold-zinc-lead-copper-silver underground mine (includes New Cobar, New Occidental, and Perseverance), 8 km S of Cobar, NSW	5
Do.	Pasminco Ltd., 100%	Port Pirie lead smelter, SA	250
Do.	do.	Rosebery underground zinc-lead-silver-copper-gold mine, 35 km N of Queenstown, TAS	23
Magnesite	Australian Magnesium Corp. Ltd., 100%	Kunwarara open pit magnesite mine (includes Marlborough), 70 km NW of Rockhampton, QLD	3,000
Manganese	Groote Eylandt Mining Co. Pty. Ltd., 100%	Groote Eylandt open pit manganese mine at Groote Eylandt, NT	2,400
Do.	Pilbara Manganese Pty. Ltd., 100%	Woodie Woodie open pit manganese mine (includes Bells and East Pilbara leases), 400 SE of Port Hedland, WA	350
Manganese alloys	Tasmanian Electro Metallurgical Co. Pty. Ltd., 100%	Bell Bay Smelter near Launceton, TAS	260

See footnotes at end of table.

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TABLE 2--Continued
AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities[1,2,3]	Annual capacity[e]
Mineral sands	Iluka Resources Ltd., 100%	Eneabba open pit heavy-mineral sands mine, 260 km N of Perth, WA	NA
Do.	Mineral Deposits Ltd., 100%	Hawks Nest heavy-mineral sands dredge, 50 km NE of Newcastle, NSW	NA
Do.	Cable Sands (WA) Pty. Ltd., 100%	Jangardup heavy-mineral sands dredge, 50 km S of Nannup, WA	NA
Do.	Iluka Resources Ltd., 100%	North Capel open pit heavy-mineral sands mine, 7 km N of Capel, WA	NA
Do.	Stradbroke Rutile Pty. Ltd., 100%	North Stradbroke Island heavy-mineral sands dredge, 35 km E of Brisbane, QLD	NA
Do.	KMCC Western Australia Pty. Ltd., 50%, and Ticor Resources Pty. Ltd., 50%	Tiwest Joint Venture heavy-mineral sands dredge, 180 km N of Perth, WA	NA
Do.	Murray Basin Titanium Pty. Ltd., 100%	Wemen heavy-mineral sands dredge, 80 km SE of Mildura, VIC	NA
Nickel	Outokumpu Exploration Ventures Pty. Ltd., 100%	Black Swan underground nickel mine (includes Silver Swan), 53 km NE of Kalgoorlie, WA	22
Do.	Preston Resources Ltd., 100%	Bulong open pit nickel-cobalt mine, 30 km E of Kalgoorlie, WA	9
Do.	OM Group Inc., 100%	Cawse open pit nickel-cobalt mine, 50 km NW of Kalgoorlie, WA	9
Do.	Jubilee Mines NL, 100%	Cosmos open pit nickel mine, 50 km N of Leinster, WA	80
Do.	WMC Ltd., 100%	Kalgoorlie nickel smelter, Kalgoorlie, WA	100
Do.	do.	Kambalda underground nickel mines, 25 km N of Kambalda to 10 km S of Widgiemooltha, WA	35
Do.	do.	Kwinana nickel refinery, Kwinana, WA	67
Do.	do.	Leinster open pit/underground nickel mines, 10 km N of Leinster, WA	44
Do.	Mincor Resources NL, 76%; Clough Mining Pty. Ltd., 12%; and Donegal Resources Pty. Ltd., 12%	Miitel underground nickel mine (includes Redross and Mariners), 70 km S of Kambalda, WA	10
Do.	WMC Ltd., 100%	Mount Keith open pit nickel mine (includes Cliffs and Yakabindie), 70 km SSE of Wiluna, WA	50
Do.	Anaconda Nickel Ltd., 60%, and Glencore International AG, 40%	Murrin Murrin nickel refinery, Murrin Murrin, WA	45
Do.	do.	Murrin Murrin open pit nickel-cobalt mine, 60 km E of Leonora, WA	100
Do.	Australian Nickel Mines NL, 100%	Radio Hill underground nickel-cobalt mine, 100 km ESE of Karratha, WA	4
Do.	QNI Pty. Ltd., 100%	Yabulu nickel-cobalt refinery, Townsville, QLD	30
Opal	Many small producers	Andamooka and Coober Pedy areas, SA; Lightning Ridge area, NSW	NA
Petroleum thousand 42-gallon barrels per day	Exxon Mobil Corporation, 100%	Altona Refinery, VIC	120
Do. do.	BP Amoco Refinery (Bulwer Island) Pty. Ltd., 100%	Bulwer Island Refinery, QLD	69.3
Do. do.	Shell Refining (Australia) Pty. Ltd., 100%	Clyde Refinery, NSW	85
Do. do.	do.	Geelong Refinery, VIC	110
Do. do.	ChevronTexaco Corp., 100%	Kurnell Refinery, NSW	114
Do. do.	BP Amoco Refinery (Kwinana) Pty. Ltd., 100%	Kwinana Refinery, WA	138
Do. do.	ChevronTexaco Corp., 100%	Lytton Refinery, QLD	106
Do. do.	Exxon Mobil Corporation, 100%	Port Stanvac Refinery, SA	69

See footnotes at end of table.

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TABLE 2--Continued
AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities[1,2,3]	Annual capacity[e]
Phosphate rock		WMC Fertilizers Ltd., 100%	Phosphate Hill-Duchess open pit phosphate mine, 140 km NW of Mount Isa, QLD	2,200
Salt		Dampier Salt Ltd., 100%	Dampier solar evaporation salt pans, 65 km N of Carnarvon, WA	5,000
Do.		do.	Lake MacLeod solar salt and gypsum evaporation pans, 65 km N of Carnarvon, WA	900
Do.		do.	Port Hedland solar salt fields, at Port Hedland, WA	3,000
Silica		Itochu Corp., 50%, and Tochu Corp., 50%	Kemerton silica sands dredge, 25 km NE of Bunbury, WA	450
Silver	kilograms	Perilya Ltd., 100%	Broken Hill underground silver-zinc-lead mine at Broken Hill, NSW	81,200
Do.	do.	BHP Minerals Ltd., 100%	Cannington underground silver-lead-zinc mine, 200 km SE of Mount Isa, QLD	700,000
Do.	do.	Pasminco Century Mine Ltd., 100%	Century open pit zinc-silver-lead mine, 250 km NW of Mount Isa, QLD	3,000
Do.	do.	Pasminco Ltd., 100%	Cockle Creek silver smelter, NSW	85,000
Do.	do.	do.	Elura underground zinc-silver-lead mine, 40 km NW of Cobar, NSW	35,000
Do.	do.	Western Metals Ltd., 100%	Hellyer underground zinc-lead-copper-silver mine, 80 km SSW of Burnie, TAS	60,000
Do.	do.	AuironGold Ltd., 100%	Henty underground gold-silver mine, 30 km N of Queenstown, TAS	1,100
Do.	do.	Thalanga Copper Mines Pty. Ltd., 70%, and BML Holdings Pty. Ltd., 30%	Highway-Reward open pit and underground copper mine, 37 km S of Charters Towers, QLD	1,000
Do.	do.	MIM Holdings Ltd., 100%	Mount Isa underground copper-lead-zinc-silver mine (also includes enterprise, George Fisher, and Hilton mines) at Mount Isa, QLD	375,000
Do.	do.	Australian Gold Refineries, 100% (State of WA agency)	Newburn silver refinery, WA	81,000
Do.	do.	WMC Olympic Dam Operations Pty. Ltd., 100%	Olympic Dam underground copper-silver-gold-uranium mine at Roxby Downs, 80 km N of Woomera, SA	12,900
Do.	do.	Paddington Gold Pty. Ltd., 100%	Paddington open pit gold-silver mine, 35 km NW of Kalgoorlie, WA	500
Do.	do.	Peak Gold Mines Pty. Ltd., 100%	Peak underground gold-zinc-lead-copper-silver underground mine (includes New Cobar, New Occidental, and Perseverance), 8 km S of Cobar, NSW	6,000
Do.	do.	Pasminco Ltd., 100%	Port Pirie silver smelter, SA	450,000
Do.	do.	do.	Rosebery underground zinc-lead-silver-copper-gold mine, 35 km N of Queenstown, TAS	35,000
Spodumene	do.	Gwalia Consolidated Ltd., 100%	Greenbushes open pit/underground tantalite-spodumene mine, 70 km SE of Bunbury, WA	100
Steel		BHP Steel Pty. Ltd., 100%	Newcastle steelworks, NSW	1,800
Do.		do.	Port Kembla steelworks, NSW	4,000
Do.		do.	Sydney (Rooty Hill) minimill, NSW	250
Do.		do.	Whyalla steelworks, SA	1,200
Talc		Luzenac Australia Pty. Ltd., 100%	Three Springs open pit talc mine, 330 km N of Perth, WA	200

See footnotes at end of table.

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TABLE 2--Continued
AUSTRALIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities[1,2,3]	Annual capacity[e]
Tantalum, tantalite, Ta_2O_5	pounds	Gwalia Consolidated Ltd., 100%	Greenbushes open pit/underground tantalite-spodumene mine, 70 km SE of Bunbury, WA	600,000
Do.	do.	do.	Wodgina open pit tantalite mine, 100 km S of Port Hedland, WA	500,000
Tin, banch (in situ)	cubic meters	Telminex NL, 100%	Ardlethan alluvial tin mine, 90 km NW of Wagga Wagga, NSW	500,000
Do.		Sons of Gwalia Ltd., 100%	Greenbushes Smelter, WA	1
Do.		Renison Bell Ltd., 100%	Renison Bell underground tin mine, 136 km S of Burnie, TAS	13
Uranium, U_3O_8	tons	Heathgate Resources Pty. Ltd., 100%	Beverley in situ leach uranium operation, 300 km NE of Port Augusta, SA	900
Do.	do.	WMC Olympic Dam Operations Pty. Ltd., 100%	Olympic Dam underground copper-silver-gold-uranium mine at Roxby Downs, 80 km N of Woomera, SA	1,500
Do.	do.	Energy Resources of Australia Ltd., 100%	Ranger open pit uranium mine, 230 km E of Darwin, NT	4,500
Vanadium, V_2O_5	do.	Xstrata Windimurra Pty. Ltd., 100%	Windimurra open pit mine vanadium, 100 km ESE of Mount Magnet, WA	8
Zinc		Perilya Ltd., 100%	Broken Hill underground silver-zinc-lead mine at Broken Hill, NSW	360
Do.		BHP Minerals Ltd., 100%	Cannington underground silver-lead-zinc mine, 200 km SE of Mount Isa, QLD	100
Do.		Pasminco Century Mine Ltd., 100%	Century open pit zinc-silver-lead mine, 250 km NW of Mount Isa, QLD	500
Do.		Pasminco Ltd., 100%	Cockle Creek zinc smelter, NSW	90
Do.		do.	Elura underground zinc-silver-lead mine, 40 km NW of Cobar, NSW	125
Do.		Murchison Zinc Co. Pty. Ltd., 100%	Golden Grove underground zinc-copper mine (includes Gossan Hill and Scuddles), 225 km E of Geraldton, WA	150
Do.		Western Metals Ltd., 100%	Hellyer underground zinc-lead-copper-silver mine, 80 km SSW of Burnie, TAS	130
Do.		MIM Holdings Ltd., 100%	Mount Isa underground copper-lead-zinc-silver mine (also includes enterprise, George Fisher, and Hilton mines) at Mount Isa, QLD	175
Do.		Peak Gold Mines Pty. Ltd., 100%	Peak underground gold-zinc-lead-copper-silver underground mine (includes New Cobar, New Occidental, and Perseverance), 8 km S of Cobar, NSW	8
Do.		Pasminco Ltd., 100%	Port Pirie zinc smelter, SA	40
Do.		do.	Ridson zinc refinery, Hobart, TAS	230
Do.		do.	Rosebery underground zinc-lead-silver-copper-gold mine, 35 km N of Queenstown, TAS	100
Do.		Sun Metals Corp. Pty. Ltd., 100%	Sun Metals zinc refinery, Stuart, QLD	170

[e]Estimated; estimated data are rounded to no more than three significant digits. NA Not available.

[1]Australian State and Territory abbreviations: NSW--New South Wales; NT--Northern Territory; QLD--Queensland; SA--South Australia; TAS--Tasmania; VIC--Victoria; WA--Western Australia.

[2]Bearing abbreviations: N--north; NNE--north-northeast; NE--northeast; E--east; SE--southeast; SSE--south-southeast; S--south; SSW--south-southwest; SW--southwest; WSW--west-southwest; W--west; WNW--west-northwest; NW--Northwest; NNW--north-northwest.

[3]Abbreviation(s) used for unit(s) of measure in this table include the following: km--kilometer.

[4]Care and maintenance; expansion project development decision pending.

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THE MINERAL INDUSTRY OF BANGLADESH

By Chin S. Kuo

Bangladesh is one of the world's most densely populated and poorest countries, with underdeveloped mineral resources that include large potential natural gas reserves. The country's gross domestic product (GDP) grew by 5.8% in 2005. The per capita GDP based on purchasing power parity was low at $2,011. Inflation remained high at 7% (International Monetary Fund, 2006§[1]). Agriculture accounted for 35% of the GDP. The Government attempted to diversify its economy away from agriculture by encouraging industrial development and natural gas exploration. Bangladesh has small reserves of coal and oil. The output of the mineral industry consisted of the production of small amounts of cement, clay, limestone, nitrogen fertilizers, salt, and steel. The Ministry of Energy and Mineral Resources has overall responsibility for the country's energy sector.

The demand for cement in the construction industry grew at a rate of from 5% to 8% per year. Bangladesh's installed capacity was more than 17 million metric tons per year (Mt/yr) from 65 mills. The cement industry was ailing and had too much capacity for current demand. Bangladesh had no abundant indigenous limestone and continued to import 6 Mt/yr of clinker. An integrated cement plant with a capacity of 1.2 Mt/yr using limestone from India was set up by Holcim (Bangladesh) Ltd. near Sylhet in northeastern Bangladesh. Commercial production was expected to begin in 2006. Holcim had a combined capacity of 1.3 Mt/yr with three plants in two locations at Meghnaghat and in southwestern Bangladesh (World Cement, 2005).

Asia Energy plc reported that core sample analysis from drilling at its Phulbari coal project in northwestern Bangladesh confirmed expectations of bituminous coal with high volatiles, low ash, and good calorific value. Some of Phulbari's coal production might be suitable for sale either as a semisoft coking coal or as a pulverized injection coal. An opencast coal mine was envisioned to produce 15 Mt/yr in 2007. A definitive feasibility study would define the deposit, which had potential reserves in excess of 400 million metric tons. The planned mine would export coal to India and provide a long-term source of sustainable energy to Bangladesh (Asia Energy plc, 2005§).

The Barapukuria coal mine being developed would produce 1 Mt/yr of coal, of which 65% would be used in the 250-megawatt (MW) coal-fired powerplant, and 35%, in brick fields and for other domestic purposes. The management and production contract was awarded to China National Machinery Import and Export Corp.; the completion date of the project was extended owing to power supply interruptions and unforeseen hydrogeologic environmental conditions. The underground mine development work was near completion, and inspection and testing were in progress in March (Barapukuria Coal Mining Co. Ltd., 2005§).

The Government's licensing round for oil and gas was scheduled for early 2006. Bangladesh was reported by state-owned Bangladesh Oil, Gas & Mineral Corp. to have significant gas reserves of approximately 433 billion cubic meters (15.3 trillion cubic feet). The country's demand for natural gas was expected to grow by 6% per year, and potential uses of natural gas included use of compressed gas for vehicles, for fertilizer and petrochemicals production, and for power generation (U.S. Energy Information Administration, 2005§).

Tullow Oil plc made a gas discovery with its Bangora-1 well on Block 9 near its Lalmai find. The well flowed at an average rate of 3.4 million cubic meters per day of gas from three zones during testing. Partners in the block were Tullow (30%) as operator, Niko Resources Ltd. of Canada (60%), and state-owned Bangladesh Petroleum Exploration and Production Co. (Bapex) (10%) (Petroleum Economist, 2005a).

In January, a fire spread at the Tengrakhali Gasfield, which is located in the Sunamganj District in northeastern Bangladesh about 400 kilometers (km) from Dhaka; the gasfield was being tested and further explored under the joint venture of Bapex and Niko. Niko had invested more than $15 million in the field. Bangladesh produced gas from 13 of 22 discovered gasfields (Reuters.com, 2005§).

In August, Unocal Corp. began commercial production at the Moulavibazar Gasfield. Output was expected to reach full capacity of 4.2 million cubic meters per day within three months, which would bring the country's total gas production to 41.6 million cubic meters per day and exceed its total demand of 41 million cubic meters per day. The $42 million development cost included a 24-km pipeline link to the national network. The next major development would be the Bibiyana Field, which would add 5.7 million cubic meters per day of production by late 2006. Unocal also operated the Jalalabad Field in Block 13, which supplied 5.7 million cubic meters per day of gas (Petroleum Economist, 2005b).

Wartsila Corp. of Finland was awarded contracts by Bangladesh's Summit Power Ltd. to supply gas-fueled generating sets for two separate powerplants at Comilla and Narsingdi. Each generating set produced up to 9 MW of power. Three generating sets for Narsingdi and two others for Comilla were due for shipment in February 2006, and both plants were expected to be fully operational and connected to the national grid by July 2006 (Wartsila Corp., 2005).

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Ministry of Energy and Mineral Resources
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Monthly Statistical Bulletin of Bangladesh.
Statistical Yearbook of Bangladesh.

TABLE 1
BANGLADESH: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Commodity[3]		2002	2003	2004	2005
Cement, hydraulic[4]	5,005,000 e	5,000,000	5,000,000	5,000,000	5,100,000
Clays, kaolin[4]	8,000	8,100	8,200	8,300	8,400
Gas, natural, marketed[4, 6] million cubic meters	7,000	7,200	7,300	8,100 r	9,400
Iron and steel, metal:[4]					
Steel, crude, ingot only	30,000	30,000	25,000	25,000	20,000
Steel products	80,000	80,000	70,000	70,000	70,000
Nitrogen, N content of urea, ammonia, ammonium sulfate	1,273,000 e	1,288,500 e	1,388,700 e	1,379,500 e	1,380,000
Petroleum:					
Crude thousand 42-gallon barrels	1,550	1,600	1,800	1,700	1,900
Refinery products do.	8,800	8,900	9,000	9,100	9,200
Salt, marine[4]	350,000	350,000	350,000	350,000	350,000
Stone, limestone[4]	30,000	32,000	34,000	36,000	37,000

r Revised.

[1] Estimated data are rounded to no more than three significant digits.

[2] Table includes data available through June 1, 2006.

[3] In addition to the commodities listed, crude construction materials, such as sand and gravel and other varieties of stone, presumably are produced, but available information is inadequate to make reliable estimates of output levels.

[4] Data are for years ending June 30 of that stated.

[5] Reported figure.

[6] Gross production is not reported; the quantity vented, flared, or reinjected is believed to be negligible.

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THE MINERAL INDUSTRIES OF BHUTAN AND NEPAL

By Chin S. Kuo

BHUTAN

Bhutan's small and underdeveloped economy was based on agriculture, forestry, and hydroelectricity. Rugged terrain provides sites to harvest hydroelectric power. Hydroelectricity and construction were the two major industries of growth in the country. The economic growth of 6.5% in terms of the gross domestic product (GDP) was the result of subregional economic cooperation efforts with Bangladesh and India. Bangladesh was Bhutan's second ranked trade partner after India. Bhutan's per capita GDP based on purchasing power parity was $3,921 and inflation was 5.2% in 2005 (International Monetary Fund, 2006§[1]). The country produced cement, coal, dolomite, ferrosilicon, gypsum, and limestone and exported cement, ferrosilicon, and gypsum.

The Department of Geology and Mines under the Ministry of Trade and Industry has two divisions. The Geological Survey of Bhutan is responsible for geologic mapping, mineral exploration, geotechnical investigations, and other services related to the geosciences. The Mining Division is responsible for the inspection and regulation of various mines to ensure that mining practices in the country are environmentally friendly. The Ministry's Department of Energy is responsible for the formulation of energy and power sector policy, plans, programs, guidelines, regulations, and the feasibility studies related to hydropower development (Ministry of Trade and Industry, 2004§).

Bhutan Ferro Alloys Ltd. was a joint venture of the Government, Marubeni Corp., and Tashi Commercial Corp. Its plant near Phuentsholing had a 28.5-megavoltampere (MVA) submerged electric arc furnace and was capable of producing 18,000 metric tons per year (t/yr) of ferrosilicon, 4,200 t/yr of micro silica, and 2,400 t/yr of magnesium ferrosilicon. The company had its own captive mines to produce quartzite for the plant. The company finalized the order for procuring an 18-MVA smelting furnace to produce other silicon and manganese alloys. The proposed expansion was commissioned at the end of 2005 (Bhutan Ferro Alloys Ltd., 2005§).

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NEPAL

Nepal, which was among the world's poorest countries, had a per capita GDP of $1,675 based on purchasing power parity. The real GDP growth was only 2.7%. Agricultural production, particularly of rice and wheat, remained Nepal's principal economic activity, employing more than 76% of the population and contributing 39% of the GDP. Declining tourism was affected by a worsening internal security situation and a global economic slowdown. The mineral industry was small and contributed little to the country's economy. The most economically important mineral commodities produced were cement, clay, coal, limestone, marble, and talc. Although the trade deficit was growing, the balance of payments was in surplus owing to remittances by Nepalis working abroad and foreign assistance. Inflation was quite high at 9.1% (International Monetary Fund, 2006§).

Nepal has small deposits of cobalt, copper, iron ore, lead, limestone, magnesite, mica, and zinc, but exploration and exploitation were difficult. The country's swift rivers that flow through the steep mountain terrain provide massive hydroelectric potential. The privately financed hydroelectric projects that provided the most power for domestic use were the Khimti Khola, with 60 megawatts (MW) of installed capacity, and the Bhote Koshi, with 36 MW. The privately owned West Seti project, with 750 MW of installed capacity, exported electricity to neighboring India (U.S. Department of State, 2006).

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TABLE 1
BHUTAN AND NEPAL: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Country and commodity[2]		2001	2002	2003	2004	2005
BHUTAN						
Cement[e]		160,000	160,000	160,000	170,000	170,000
Coal		84,596 r	88,567 r	66,324 r	29,631 r	85,279
Dolomite		338,846 r	388,056 r	367,402 r	452,336 r	388,711
Ferrosilicon[e]		16,000	21,000	21,000	21,147 r,3	20,000
Granite	square meters	--	516	1,076	200	877
Gypsum		100,907 r	105,658 r	122,829 r	131,236 r	150,585
Iron ore		--	--	--	--	5,679
Limestone		514,976 r	506,268 r	551,525 r	560,807 r	536,030
Marble	square meters	464 r	298 r	579 r	314 r	372
Quartzite		47,511 r	47,464 r	52,058 r	42,599 r	52,694
Shale, green and pink		136	937	--	--	363
Slate	square meters	-- r	567 r	5,386 r	11,779 r	270
Stone		10,375	319,702	316,068	246,508	146,767
Talc		13,528 r	23,118 r	23,101 r	39,797 r	42,791
NEPAL						
Cement[e]		285,000	290,000	295,000	285,000 r	290,000
Clay, red		2,700 e	2,600 e	32,966	29,234	35,484
Coal:						
Bituminous		16,589	9,612	11,848	10,459	9,259
Lignite		--	--	--	58	39
Total		16,589	9,612	11,848	10,517	9,298
Gemstones:						
Quartz	kilograms	1,135	1,720	1,765	1,215	1,092
Tourmaline	do.	--	--	--	--	7
Total	do.	1,135	1,720	1,765	1,215	1,099
Lime, agricultural		15,587	20,000	13,025	--	--
Magnesia, dead-burned		--	--	--	50	56
Salt	thousand metric tons	5	5	5	4	2
Steel, rolled[e]		110,000	100,000	100,000	95,000	90,000
Stone:						
Limestone		287,810	356,218	269,379	388,109	263,701
Marble:						
Chips		607	537	395	481	436
Slab, cut	square meters	54,834	46,156	46,197	56,014	23,850
Craggy	do.	1,333	2,279	681	728	--
Quartzite[e]		2,800	2,800	2,900	2,900	3,000
Talc		3,923	2,621	6,905	3,435	5,832

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. -- Zero.

[1]Table includes data available through August 15, 2006.

[2]In addition to the commodities listed, crude construction materials, such as sand and gravel and a variety of stone, presumably are produced in Bhutan and Nepal, but information is inadequate to make reliable estimates of output levels.

[3]Reported figure.

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The Mineral Industry of Brunei

By Pui-Kwan Tse

Negara Brunei Darussalam (Brunei) is located on the northwest end of Borneo Island, which has a common border with the Malaysian State of Sarawak in Southeast Asia. The country's land mass is about 5,270 square kilometers and its population was about 372,000 in 2005. Brunei is one of the highest per capita income countries in the Asia and the Pacific region owing mainly to its significant natural gas and oil resources. In addition to the natural gas and oil resources, Brunei also has small resources of coal, carbonate rocks, kaolin, sand and gravel, and silica sand.

Brunei's economic growth rate was 3.0% in 2005 compared with 1.7% in 2004. In 2005, the gross domestic product (GDP) increased to $6.40 billion and the GDP per capita reached $17,632 compared with $5.69 billion and $16,000, respectively, in 2004 (International Monetary Fund, 2006§[1]). Owing in part to high oil prices during the year, the natural gas and oil sector's share of the GDP increased to about 57%; the nonoil sectors accounted for 43% of the GDP, of which 15% was from the Government sector and 28% was from the private sector (BruneiDirect.com, 2006e§). The rate of inflation as measured by the consumer price index (CPI) rose by 1.1% 2005 compared with 0.9% in 2004. The higher rate in 2005 was mainly a reflection of the increase in transportation costs. The nonoil sector grew by 5.1% and the natural gas and oil sector contracted by about 1.4% in 2004 (BruneiDirect.com, 2006a§).

During the past few decades, the country's economic growth was stimulated mainly by Government mega projects and friendly investment incentives for foreign partners and investors. The Government planned to decrease economic dependence in the energy sector and to transform Brunei into a regional hub for services. The Government intended to develop the transportation and communication sectors, reform the financial system, and eliminate regulations that discourage foreign investment. The banking, finance, insurance, and pawn acts were expected to be amended. These changes would allow authorities to supervise financial institutions as in developed countries to ensure that their operations are based on international standards. The changes were aimed at enabling the private sector to be the engine of growth in the future. The Commonwealth Fund for Technical Cooperation provided financial and technical assistance to Brunei's Government to enact these reforms (BruneiDirect.com, 2006c§).

Butra Heidelberg Cement Sendirian Berhad, which was the only cement producer in Brunei, was a joint venture between a local company, "Butra," and HeidelbergCement Group of the Netherlands. Butra Heidelberg Cement had the capacity to produce 500,000 metric tons per year (t/yr) of specialty cement from imported clinker and gypsum at its cement grinding plant, which is located near Muara. The specialty cement is used mainly by the oil well and sulfate resistance sectors. During the past few years, cement production at the plant averaged 250,000 t/yr, or about 50% of design capacity. Owing to the expansion of the construction sector, demand for cement has increased sharply during the past 2 years. The price of domestically produced cement increased to about $180 per metric ton, which was much higher than the same kind of cement imported from Singapore, which cost between $110 and $120 per metric ton. To meet the demand, the Government decided to allow cement to be imported to Brunei again, mainly from China, Indonesia, Malaysia, and Thailand (BruneiDirect.com, 2006b§).

Because the natural gas and oil sector contributed more than 55% of the GDP and 90% of exports, sustained development of this sector was expected to drive future economic growth for Brunei. During the past 2 years, the output of the natural gas and oil sector continued its decline at a modest pace from its peak of 230,000 barrels per day (bbl/d) in 1979, to 201,738 bbl/d in 2004 and 193,504 bbl/d in 2005 (BruneiDirect.com, 2006d§).

The Petroleum Unit oversees the development of the natural gas and oil sector for the Brunei Government. Brunei Shell Petroleum Sdn. Bhd. (BSP), which was the main oil and gas production company in Brunei, was jointly owned by the Government and Royal Dutch/Shell Group of the Netherlands. Its refinery output capacity of 10,000 bbl/d was sufficient to meet the domestic demand for most oil products. In 2005, Indonesia accounted for 29% of Brunei's crude oil exports, followed by the Republic of Korea, 15.4%; Australia, 14.9%; Japan, 12.3%; the United States, 9.6%; China, 5.9%; Thailand, 4.9%; India, 4.4%; New Zealand, 2.3%; and Singapore, 1.3%. Natural gas was exported as liquefied natural gas mainly to Japan and the Republic of Korea (Petroleum Unit, 2006§).

Four offshore deepwater exploration activities were ongoing at the Brunei Exclusive Economic Zone. Block J was awarded to a three-member consortium that was headed by Total S.A. of France. A consortium that included ConocoPhillips Company, Mitsubishi Corp., and Shell Deepwater Borneo, a subsidiary of BSP, won the bid for Block K. Block L was awarded to the joint venture of Loon Energy Inc. and QAF Brunei Sdn. Bhd., and Block M was awarded to the joint venture of China Oil USA (Macao) Co. Ltd., Jana Corporation Sdn Bhd., and Valiant International Petroleum Ltd. (Petroleum Unit, 2006§).

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TABLE 1
BRUNEI: PRODUCTION OF MINERAL COMMODITIES[1]

Commodity[2]		2001	2002	2003	2004[e]	2005[e]
Cement	thousand metric tons	227	241	235	242 [r]	266 [r]
Gas, natural:						
Gross	million cubic meters	11,687	11,790	12,702	13,000	13,500
Marketed	do.	10,967	11,120	12,024	12,500	13,000
Petroleum:						
Crude[4]	thousand 42-gallon barrels	71,199	72,000	75,642	72,500	70,000
Refinery products:	do.					
Gasoline	do.	1,647	1,646	1,717	1,750	1,780
Kerosene	do.	579	616	634	650	660
Distillate fuel oil	do.	1,112	1,109	1,195	1,200	1,220
Residual fuel oil	do.	497	463	511	530	540
Other[5]	do.	533	626	582	580	580
Total	do.	4,368	4,460	4,639	4,710	4,780

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown.
[1]Table includes data available through August 30, 2006.
[2]In addition to the commodities listed, crude construction materials, such as sand and gravel and other varieties of stone, presumably are produced, but available information is inadequate to make reliable estimates of output levels.
[r]Reported figure.
[4]Includes condensate.
[5]Includes jet fuel, refinery fuel, and refinery losses.

Sources: Prime Minister's Department, Petroleum Unit and U.S. Geological Survey Minerals Questionnaire, 2002-06.

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The Mineral Industry of Burma

By Yolanda Fong-Sam

Burma is located in Southeast Asia and is bordered by the countries of Bangladesh, China, India, Laos, and Thailand; the Andaman Sea; and the Bay of Bengal. This country has an area of 678,500 square kilometers (km²) and had an estimated population of 50.5 million in 2005 (U.S. Central Intelligence Agency, 2006§[1]; World Bank Group, 2006§).

In 2005, Burma's gross domestic product (GDP) based on purchasing power parity was estimated to be $93.8 billion, and the GDP per capita based on purchasing power parity was estimated to be $1,700. Burma's economy was based primarily on agriculture, which included fisheries, forestry, livestock, rice, and sugarcane; agriculture accounted for nearly 57% of the GDP in 2005. Other sectors that contributed to Burma's economy were industry and services, which accounted for almost 8% and 35%, respectively, of the GDP (International Monetary Fund, 2006§; U.S. Central Intelligence Agency, 2006§). The country's mineral production included antimony, coal, copper, gemstone, lead, limestone, natural gas, petroleum, precious stones, tin, tungsten, and zinc.

Burma's export market totaled about $3.1 billion during 2005; imports totaled about $3.5 billion. Exports included such commodities as clothing, fish, natural gas, and rice; import goods included construction materials, transport equipment and machinery, food products, crude oil, petroleum products, and plastics. During 2005, Burma's main export partners were Thailand (44.3%), India (12.3%), China (6.8%), Japan (5%), and others (31.6%); its import partners were China (28.8%), Thailand (21.8%), Singapore (18.3%), Malaysia (7.6%), and others (23.5%) (U.S. Central Intelligence Agency, 2006§).

During the first quarter of 2004, the Confederation of Indian Industries and the Union of Myanmar Federation of Chambers of Commerce and Industries signed a memorandum of understanding (MOU) to create a task force to increase trade between Burma and India. The 2005 trade value between the two countries was estimated to be $470 million; both Governments expressed interest in increasing the Burma-India trade value to $1 billion during the next several years. Burma also intended to increase cooperation and support for its information and communication technology areas and its energy sector, and to put in place programs to attract small- and medium-size enterprises (BurmaNet News, 2005§).

In August 2005, the mine and minerals ministers of all the members of the Association of Southeast Asian Nations (ASEAN) approved the ASEAN Minerals Cooperation Action Plan (AMCAP) 2005-10. The agreement consisted of a cooperation plan to promote each ASEAN member country's mining sector. The countries that belong to ASEAN are Brunei, Burma, Cambodia, Indonesia, Laos, Malaysia, the Philippines, Singapore, Thailand, and Vietnam. The agreement encourages the development of the minerals sector as a way to promote economic growth and social progress, enhance trade and investments, and encourage the use of environmentally friendly and socially responsible mineral development practices in the ASEAN region (Mining Journal, 2005).

Commodity Review

Metals

Copper.—During 2005, copper mine production in Burma reached 34,500 metric tons (t). This was an approximate increase of 9% compared with that of 2004 and 24% compared with that of 2003 (table 1).

The Monywa Copper Project, which is located in west-central Burma approximately 110 kilometers (km) west of Mandalay, 15 km west of Monywa, and 832 km north of Yangon, comprises the following deposits: Kyisintaung, Letpadaung, Sebetaung, and Sebetaung South. The first phase of the Monywa Copper Project was developed as the S&K Mine, which covered a 30.59-km² area and encompassed the Kyisintaung, the Sabetaung, and the Sabetaung South deposits.

The Monywa Copper Project was a 50-50 joint venture between Ivanhoe Myanmar Holdings Ltd. (IMHL) (a wholly owned subsidiary of Ivanhoe Mines Ltd. of Canada) and state-owned Mining Enterprise No. 1 (ME1). The Canadian company operated in Burma through Myanmar Ivanhoe Copper Company Limited (Monywa JVCo), which was a company incorporated in Burma. Monywa JVCo had a copper sales agreement with Marubeni Corporation, which had an exclusive right to market the copper throughout the world. The sales agreement expired on December 31, 2005, but the companies negotiated an extension of the agreement to December 31, 2006. Also in 2005, Monywa JVCo began its facility expansion program, which, when fully implemented, will increase the copper processing rate to 50,000 metric tons per year (t/yr) of copper cathode. Production in 2005 decreased owing to a decrease in copper grades at the Sabetaung deposit (Ivanhoe Mines Ltd., 2006).

Mineral Fuels

Natural Gas.—The amount of natural gas marketed in Burma during 2005 was 11,648 million cubic meters, which was an increase of about 13% compared with that of 2004 and 19% compared with that of 2003 (table 1). Burma's recoverable onshore and offshore gas reserves were estimated to be 87 trillion cubic feet (2.46 trillion cubic meters) (Alexander's Gas & Oil Connections, 2005e§).

In early 2005, a consortium of foreign oil companies with interest in Burma's gasfields announced the discovery of additional natural gas deposits in the Shwe field, which is located offshore within Block A1 along the western Rakhine coast. The discovery found an estimated 170 billion cubic

[1]References that include a section mark (§) are found in the Internet References Cited section.

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meters (reported as 6 trillion cubic feet) of gas in Block A1, from which initial exploration gas estimates in 2004 were up to 396.2 billion cubic meters (reported as 14 trillion cubic feet). As a result of the new discovery, Block A1's total gas estimates were revised to 566 billion cubic meters (reported as 20 trillion cubic feet). Block A1 was owned by a consortium made up of Korean companies Daewoo International Corp. (60%) and Korea Gas (10%) and Indian companies Oil and Natural Gas Corporation (ONGC) Videsh Ltd. (OVL) (20%) and Gas Authority of India Ltd. (GAIL) (10%) (Alexander's Gas & Oil Connections, 2005d§). In late 2005, the consortium partners of Block A1 announced that, according to an independent assessment made by the oil-industry consultant Ryder Scott Co., estimated gas reserves in Block A1's Shwe field zone were between 2.88 trillion cubic feet and 3.56 trillion cubic feet (Alexander's Gas & Oil Connections, 2005a§; Daewoo International Corp., 2005§; Oil and Natural Gas Corporation (ONGC) Videsh Ltd., 2005§).

The Indo-Korean consortium also held gas exploration rights to Block A3. Block A3 is located on the southern edge of Block A1 in the Bay of Bengal and measures approximately 6,780 km². In October 2005, the consortium announced that it had reached an agreement to explore Block A3 (Alexander's Gas & Oil Connections, 2005c§).

In 2005, Burma reported an increase in natural gas exports to the Asia and the Pacific region from two offshore gasfields located in the Gulf of Martaban—Yadana, which covers an area of 26,140 km², and Yetagun, which covers an area of 24,130 km². Since gas exports started, production at the Yadana field has increased to 650 million cubic feet per day from 65 million cubic feet per day in 1998; the Yetagun field exports have risen to 460 million cubic feet per day from 200 million cubic feet per day in 2000 (Alexander's Gas & Oil Connections, 2005e§).

The main operator at the Yadana gasfield was France-based Total E&P Myanmar (31.24%). Other partners included Unocal Myanmar (28.26%), Thailand based PTT Exploration and Production Public Company Limited International Limited (PTTEP) (25.5%), and Myanma Oil and Gas Enterprise (MOGE) (15%). The main operator in the Yetagun gasfield was Petronas Carigali Myanmar Inc. (40.91%). Other partners included MOGE (20.45%) and PTTEP and Nippon Oil Exploration (Myanmar) Limited (19.32% each) (PTT Exploration and Production Public Company Limited, 2006§).

Petroleum.—According to Government statistics, Burma had 19 onshore and 3 main offshore oilfields and gasfields. Reserves were estimated to be 3.2 billion barrels of recoverable crude oil. In 2005, Burma produced 8.133 million barrels of crude oil compared with 7.160 million barrels in 2004; this marked an increase of 13.6% and 12.9% respectively, compared with production in 2003 (table 1).

In May 2005, the Indian oil company Essar Oil Limited announced that it had signed two production-sharing contracts with state-owned MOGE for oil exploration—one offshore and the other onshore. The Indian company planned to conduct a feasibility study, which would involve collecting geologic, seismic, and well-drilling data; reprocessing and reinterpreting geologic and seismic data; generating geologic maps; and identifying and modeling potential prospects. Essar expected to complete the feasibility study within a period of 1 year (Alexander's Gas & Oil Connections, 2005b§).

Outlook

By 2006, trade between Burma and India is expected to increase as a result of the MOU signed in 2004. Production in the mining sector will likely follow the trend of recent years in which the mining sector was dominated by the copper, natural gas, and petroleum industries.

Natural gas exploration activities in Burma are expected to continue to increase during 2006 mainly as the result of the many exploration projects and discoveries that were started in 2005. In 2006, the Indo-Korean consortium that holds interests in offshore natural gas Blocks A1 and A3 plans to start appraisal wells in Block A1 and to begin an exploration drilling program in Block A3 (Oil and Natural Gas Corporation (ONGC) Videsh Ltd., 2005§).

Expansion and development plans in the S&K Mine is expected to increase annual copper production capacities within the next few years. In the meantime, a decline in copper production is expected during 2006 owing to decreased copper grades encountered in the Sabetaung deposit in 2005.

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TABLE 1
BURMA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2001	2002	2003	2004	2005
METALS						
Chromium, chromite, gross weight[e]		3,000	3,000	3,000	3,000	3,000
Copper:						
Mine output, Cu content		25,800	27,500	27,870	31,756	34,500
Matte, gross weight[3]		50 r	26 r	79 r	80 r,e	80 e
Metal, refined		25,800	27,500	27,870	31,756	34,500
Gold, mine output, Au content[3]	kilograms	105 r	92 r	90 r	90 r,e	90 e
Iron and steel:[e, 3]						
Pig iron		1,500	1,500	1,500	1,500	1,500
Direct-reduced iron		40,000	40,000	40,000	40,000	40,000
Steel, crude		25,000	25,000	25,000	25,000	25,000
Lead:						
Mine output, Pb content[4]		900 r	2,000 r	2,000 r	2,000 r	2,000
Metal:						
Refined		1,105	425 r	888	289	907
Antimonial lead (93% Pb)[3]		40 r	2 r	21 r	-- e	-- e
Manganese, mine output, Mn content[e]		50	50	50	50	50
Nickel:[e]						
Mine output, Ni content		10	10	10	10	10
Speiss (matte), gross weight[3]		23 r	7 r	12 r	10 r,e	10 e
Silver, mine output, Ag content[4]	kilograms	1,804	778 r	778	1,120	2,302
Tin, mine output, Sn content:[4]						
Of tin concentrate		503 r	302 r	434	330	402
Of tin-tungsten concentrate		156 r	154 r	172	196	306
Total		659	456	606	526	708
Metal, refined[e]		30	30	30	30	30
Tungsten, mine output, W content:[4]						
Of tungsten concentrate		1	1 r	3	1	2
Of tin-tungsten concentrate		85 r	83 r	93	106	166
Total		86	84	96	107	168
Zinc, mine output, Zn content[4]		467	138 r	127	196	78
INDUSTRIAL MINERALS						
Barite		31,015	15,050 r	4,850	2,224	2,058
Cement, hydraulic		377,961	470,858 r	571,505	518,999	543,072
Clays:[3]						
Bentonite		634	1,104 r	856 r	800 r,e	800 e
Fire clay and fire clay powder		770 r	332 r	130 r	100 r,e	100 e
Feldspar[e, 3]		10,000	10,000	10,000	10,000	10,000
Gypsum		64,609	90,002 r	66,069	71,155	67,522
Nitrogen, N content of ammonia		28,000	21,000	62,500	34,800 e	30,000 e
Precious and semiprecious stones:						
Jade	kilograms	8,173,936 r	10,878,789 r	10,692,780	12,407,576	19,445,758
Diamond[e]	carats	5	5	5	5	5
Rubies, sapphires, spinel	do.	8,630,000 r	4,579,624 r	4,378,545 r	6,198,915 r	5,219,817
Salt[e, 5]	thousand metric tons	35	35	35	35	35
Stone:						
Dolomite		4,922	3,806 r	4,572	4,184	3,980
Limestone, crushed and broken[e]	thousand metric tons	2,600	3,200	3,500	3,300	3,400
MINERAL FUELS AND RELATED MATERIALS						
Coal, lignite		41,736	115,175 r	109,214	237,949	229,647
Gas, natural:						
Gross[e]	million cubic meters	9,700	9,400	9,400	9,400	9,400
Marketed	do.	8,804	9,353 r	9,799	10,277	11,648

See footnotes at end of table.

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TABLE 1--Continued
BURMA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2001	2002	2003	2004	2005
MINERAL FUELS AND RELATED MATERIALS--Continued						
Petroleum:						
Crude	thousand 42-gallon barrels	4,696	6,387 [r]	7,204	7,160	8,133
Refinery products[6]	do.	5,286	6,028 [r]	5,835	5,133	4,638

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. -- Zero.

[1]Table includes data available through November 2006.

[2]In addition to the commodities listed, construction aggregates, sand and gravel, and silica sand are produced, but available information is inadequate to make reliable estimates of output levels.

[3]Data are for fiscal year ending March 31 of the following year.

[4]Data are for the production by the state-owned mining enterprises under the Ministry of Mines.

[5]Brine salt production, in metric tons, reported by the Government was 2001--61,466; 2002--59,825; 2003--73,112; 2004--58,395 and 2005--116,768.

[6]Includes diesel, distillate fuel oil, gasoline, jet fuel, kerosene, and residual fuel oil.

Sources: International Fertilizer Industry Association, Ammonia Statistics 2004; Ministry of Mines and Central Statistical Organization (Yangon), Statistical Yearbook 2004; Selected Monthly Economic Indicators, December 2005; World Bureau of Metal Statistics, August 2006.

TABLE 2
BURMA: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement		Union of Myanmar Economic Holdings Limited	Sinmin Cement plant	146,000
Coal		No. 3 Mining Enterprise	Kalewa Coal Mine in Sagaing Division, near Kalewa	13,000
Copper		Ivanhoe Myanmar Holdings Ltd. (50%) and Mining Enterprise No.1 (50%)	Monywa Copper Project, the S&K Mine and the Monywa refinery, located in central Burma	40,000
Fertilizer, N content		Myanma Petrochemical Enterprise, 100% state-owned	No. 1 Fertilizer plant at Sales, 190 kilometers southwest of Mandalay	94,900
Do.		do.	No. 2 Fertilizer plant at Kyun Chaung, central Burma	75,555
Do.		do.	No. 3 Fertilizer plant at Kyaw Zwar, central Burma	219,000
Natural gas	million cubic meters	Total E&P Myanmar (31.24%), Unocal Myanmar (28.26%), PTT Exploration and Production Company Limited International Limited (25.5%), Myanma Oil and Gas Enterprise (MOGE)(15%)	Yadana Gasfield in Moattama, Gulf of Martaban	7,227
Do.	do.	Petronas Carigali Myanmar Inc. (40.91%), Myanma Oil and Gas Enterprise (MOGE) (20.45%), PTT Exploration and Production Company Limited International Limited (19.32%), and Nippon Oil Exploration (Myanmar) Limited (19.32%)	Yetagun Gasfield in Tanintharyi, Gulf of Martaban	4,635
Do.	do.	Myanmar Petroleum Resources Limited and Myanma Oil and Gas Enterprise (MOGE)	Mann Oilfield, south of Yangon	37
Petroleum:				
Crude	thousand 42-gallon barrels	do.	do.	876
Refined	do.	Myanma Petrochemical Enterprise, 100% state-owned	No. 1 Refinery at Thanlyin (near Yangon)	9,490
Do.	do.	do.	No. 2 Refinery at Chauk, central Burma	2,190
Do.	do.	do.	No. 3 Refinery at Thanbayakan, central Burma	9,125
Steel		Myanmar POSCO Steel Co. Ltd. (70%)	POSCO steel plant in Yangon	30,000

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THE MINERAL INDUSTRIES OF CAMBODIA AND LAOS

By John C. Wu

CAMBODIA

Cambodia, which is located north of the Gulf of Thailand, south of Laos, southeast of Thailand, and southwest of Vietnam in Southeast Asia, is a small country with a total area of about 181,000 square kilometers (km^2) or about the size of Missouri. In 2005, Cambodia had a population of 13.6 million. The country was one of the poorest and least developed in the Asia and the Pacific region. Its per capita gross domestic product (GDP) and GDP based on purchasing power parity were estimated to be $2,116 and $30.6 billion, respectively, in 2005 (International Monetary Fund, 2005§; U.S. Central Intelligence Agency, 2005§[1]).

The country's mineral resources were largely untapped. The identified mineral resources were carbonate rocks, manganese, phosphate, ruby, salt, and zircon. Besides offshore natural gas and petroleum resources, Cambodia has geologic environments that have the potential to host resources of bauxite, coal, copper, gold, granite, iron ore, kaolin, lead, limestone, peat, sand and gravel, sapphire, silica sand, slate, tin, and zinc (World Investment News, 2004§).

To attract domestic and foreign mining companies to invest in mineral exploration and development, the Law of Minerals Management and Mining of Cambodia was promulgated by the Government on July 13, 2001 (United Nations, 2002§). The Ministry of Industry, Mines, and Energy (MIME) is the main Government agency that implements the law and the country's mineral policy. The Department of Geology and Mines and the Department of Energy under the MIME are responsible for developing the country's mineral resources, providing mining assistance to the private sector, and administering mining-related regulations and inspections (Asian Journal of Mining, 2000).

The mining sector, which according to Cambodian National Institute of Statistics was the smallest sector of the Cambodian economy, contributed only 0.27% to the country's GDP in 2004 (the latest year for which data were available) (National Institute of Statistics, 2005§). In 2005, Cambodia's real GDP was estimated to have grown by 6.3% compared with 7.7% (revised) in 2004. The country's GDP in current prices was $5.4 billion compared with $4.9 billion in 2004 (International Monetary Fund, 2005§).

According to Government official statistics, the mining activities in Cambodia during the past 2 years involved the production of laterite blocks (red soil) and construction materials, which included sands and crude stones. Other minerals, such as gemstones and gold, reportedly had been mined by illegal miners in the central Province of Kampong Cham, and the northeastern Provinces of Mondol Kiri and Rotano Kiri. In the past several years, illegal miners used highly toxic chemicals in gold mining that caused serious environmental damage to the Cambodian countryside and posed a health hazard. The official records, however, showed no gold production in Cambodia for the past 5 years.

At the 2005 Asia Mining Congress, the Cambodian Government revealed through the MIME that it would ask the World Bank to help finance a comprehensive mapping of the country's mineral resources. According to the MIME, before Cambodia opens its door for mining, the country must clear the areas rich in minerals of land mines and underground bombs left behind by almost 20 years of civil war following the 1979 fall of the Khmer Rouge. According to the MIME, to attract exploration companies, the Government reportedly approached Oxiana Ltd. of Australia and Asian Mineral Resources Ltd. of New Zealand, which were active in the Southeast Asia region. The Government reportedly had set a priority on developing bauxite, gold, and iron ore resources and planned to introduce stricter legislation to govern its mining sector. For example, small mines would be required to buy licenses, pay taxes, and adhere to environmental regulations. The Government also would extend the 2-year term of exploration licenses granted to prospectors. If a project reached mining stage, then a 7-year permit would be granted (Planetark.com, 2005§; Reuters Foundation AlertNet, 2005§).

In March 2005, two 2-year exploration licenses were awarded to a Cambodian-Chinese joint venture to explore for iron ore in Preah Vihear Province, and another was awarded to Delcom Cambodia Co. Ltd., which was partly owned by a Malaysian company, to explore for gold in Mondol Kiri Province. The Cambodian-Chinese joint venture comprised China National Machinery & Equipment Corp., Cambodia's Pheapimex Group, and Ratanak Stone Cambodia Development Co. Ltd. (People's Daily Online, 2005§; Reuters Foundation AlertNet, 2005§).

In June 2005, Cambodian Ventures Limited (CVL) of the United States announced that it had signed a definitive agreement to acquire gold exploration interests from Oksan Cambodia Corp. Under the agreement, CVL acquired an 85% interest in an 84-km^2 mineral exploration license in an area called Antrong in the Keo Seima District of Mondol Kiri Province, where Oksan reportedly had been working for more than 6 years. Based on its initial survey, Oksan estimated that the license area contains about 6.3 million metric tons (Mt) of gold-bearing ore. CVL was a junior mining company established in 1995 that initially focused on developing hydroelectric generation opportunities in Cambodia, but which in June 2004, shifted its focus to exploration and mining of precious minerals in Cambodia. In October 2005, CVL and Monterra Mining Inc. of Canada announced that they had entered into a joint-venture agreement for Monterra to invest up to $1 million in mining projects in Cambodia. According to CVL, the funding commitment by Monterra would allow CVL to acquire more working interests in Cambodian precious minerals mines (Cambodian Ventures Ltd., 2005a§-c§).

[1]References that include a section mark (§) are found in the Internet References Cited sections.

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Cambodia reported no proven reserves of natural gas and petroleum. Cambodia and Thailand had overlapping claims in an area of the Gulf of Thailand that covers about 27,000 km^2; this area was thought to be rich in hydrocarbons. In 2002, the Cambodian National Petroleum Authority awarded Block A, which covers a 6,278-km^2 area in the overlapping claims area, to a consortium led by ChevronTexaco Corp. of the United States.

On January 12, 2005, ChevronTexaco announced that its affiliate, Chevron Overseas Petroleum (Cambodia) Ltd. (COPCL) (55%) and its partners, Japan's Mitsui Oil Exploration Co. (Moeco Cambodia) (30%) and the Republic of Korea's LG-Caltex Oil Corp. (15%), had discovered oil in four exploration wells in offshore Cambodia Block A, which is located about 130 kilometers (km) off the west coast of Cambodia. The 6,278-km^2 block encompasses the Khmer Basin, which has water depths that average 240 feet. A sample analysis indicated the oil is 44° API crude (Alexander's Gas & Oil Connections, 2005§; Chevron Corp., 2005§). According to the Cambodian National Petroleum Authority, the joint venture was studying the economic viability of the find, and COPCL was expected to drill six appraisal wells and four more exploration wells in early 2006. If the findings are positive, then oil production may begin as early as 2008 (Embassy of Cambodia in New Zealand, 2005§).

In April 2005, the X-Change Corporation of the United States was awarded oil and gas research and exploration rights to offshore Cambodia Blocks A and B by the Government of Cambodia. The X-Change Corporation's offshore block encompasses about 6,500 km^2 and is located about 200 km off the west coast of Cambodia. The offshore block covers about 1,500 km^2 in the northwest corner of Tonle Sap Basin. The Dallas, Texas-based oil and gas company and the Cambodian National Petroleum Authority had been working towards the joint-production agreement to explore and develop oil reserves in the Tonle Sap Basin (OilOnline.com, 2005§).

In August 2005, a joint venture led by PTTEP International Ltd. (30%) of Thailand (the project operator) and its partners SPC Cambodia (30%) (a subsidiary of Singapore Petroleum Company Limited), Resources Petroleum Limited (30%), and Cooper Energy Limited (10%) entered into an agreement with the Cambodian National Petroleum Authority to explore for oil and gas in offshore Block B, which is located 250 km off the coast of Cambodia to the east of the Thai-Cambodia overlapping claims area in the Gulf of Thailand. The block lies to the southeast of the Khmer Basin, where several oil and gas discoveries had been made. The 3-year exploration program would drill one exploration well and acquire 200 km^2 of three-dimensional seismic data (Rigzone.com, 2005§). In October 2005, Indocan Resources Inc. of the United States, which was a small Texas-based oil and gas exploration company, announced that it had filed applications with the Cambodian Government for the exploration rights to coastal areas and offshore areas of the country (Indocan Resources Inc., 2005§).

The Cambodian mining sector is expected to grow slowly as the gold and iron ore mines are developed and to begin ore production during the next 2 to 3 years; the sector is expected to remain small relative to other sectors of the Cambodian economy for the next 2 years, however, unless economically viable reserves of oil and natural gas in Block A being developed by ChevronTexaco begin to produce oil and gas by 2008. Cambodia's economy as measured by the GDP was forecasted to grow by 6.1% in 2006 (International Monetary Fund, 2005§).

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LAOS

Laos, which is located north of Cambodia, southeast of Burma, south of China, northeast of Thailand, and west of Vietnam in Southeast Asia, is a small landlocked country with a total area of about 237,000 km^2 or slightly larger than Utah. In 2005, it had a population of about 6.2 million. Laos was one of the poorest and least developed countries in the Asia and the Pacific region. In 2005, the per capita GDP and the GDP based on purchasing power parity were estimated to be $2,049 and $12.1 billion, respectively (International Monetary Fund, 2005§; U.S. Central Intelligence Agency, 2005§).

The identified mineral resources in Laos were barite, clays, coal, copper, dolomite, gold, graphite, gypsum, limestone, rock salt, sapphire, silver, tin, and zinc. Laos has geologic environments that have the potential to host such other resources as antimony, asbestos, bismuth, cobalt, iron ore, kaolin, lead, lignite, manganese, molybdenum, potash, silica sand, and tungsten. The country has geologic environments that are favorable for the discovery of coal, copper, gold, iron ore, potash, rock salt, and tin (Asian Journal of Mining, 2000).

According to the Ministry of Industry and Handicraft (MIH), because of the successful copper and gold projects of Australia's Oxiana and Pan Australian Resources Ltd. (formerly Pan Australian Resources N.L.) in Laos, more than 50 domestic and international companies were exploring for copper, iron ore, and zinc in Laos. Several companies from China and Vietnam—some of which had financial backing from North America and Europe—reportedly had applied for licenses to explore for iron ore and potash in Laos in 2005 (Planetark.com, 2005§).

Laotian real GDP growth in 2005 was estimated to be 7.3% compared with 6.4% in 2004 (International Monetary Fund, 2005§). The mining sector, which was dominated by the mining of copper, gold, gypsum, limestone, and tin, was becoming an important sector of the Laotian economy because of its increasing contribution to the country's GDP. As a result of increased output of copper, gold, and silver, the mining sector was estimated to have contributed more than 3% to the country's GDP in 2005 compared with an estimated 0.3% in 2004. According to the MIH, the mining sector accounted for about one-third of Laotian industrial earnings, which in turn contributed about 26% of the Laotian GDP. According to a media report in 2005, gold production alone accounted for 2.4% of the Laotian GDP in 2004 (Oxiana Ltd., 2005b§; Planetark.com, 2005§).

In 2005, production of mineral commodities in Laos included barite, carbonate rocks (construction aggregate and limestone), clay, coal, copper, gemstones (ruby and sapphire), gold, gypsum, rock salt, sand and gravel, silver, tin, and zinc (table 1). Coal, copper, gold, gypsum, and zinc were the major mineral commodities produced in 2005. Coal was produced by the State Coal Mining Enterprise from the Chskeui Mine in Salavan Province, the Hongsa Mine in Sayaboury Province, and the Vieng Poukha Mine in Luangnamtha Province. Copper and gold were produced by Oxiana from its Sepon gold project at Sepon open pit and at the Khanong pit near the town of Sepon in Savannakhet Province and by Pan Australian Resources from its Phu Bia project north of Vientiane, which is the national capital of Laos. Gypsum was produced by the State Gypsum Enterprise from the Dong Hene Mine in Savannakhet Province. Zinc was produced by the joint venture of the Laotian Government and Thai Padaeng Industry Public Co. Ltd. from Kaiso Mine in Vang Vien, Vientiane Province, and by First Pacific Mining Company from the Pha Luang Mine, which is also located in Vang Vien.

For the first time in its modern history, Laos joined the ranks of the world's copper producers, with the first cathode copper produced from Oxiana's Sepon project in March 2005. The project's 60,000-metric-ton-per-year (t/yr) copper-processing plant, which is located about 3 km south of the Khanong pit and uses Outokumpu Technology's solvent extraction-electrowinning process, was completed by Outokumpu Technology (which was part of Outokumpu Group) in February 2005. The production of cathode copper began on March 14, which was two weeks ahead of schedule, and the first load of 60 metric tons (t) of Laotian copper was shipped to Thailand at the end of March 2005. According to Oxiana, the Sepon copper plant processed 1.3 Mt of ore and produced 30,480 t of cathode copper in 2005 as planned and was expected to produce 60,000 t in 2006. Oxiana planned to sell Sepon's copper to cable, tube, and wire manufacturers in China Malaysia, Taiwan, Thailand, and Vietnam (Oxiana Ltd., 2005a§, c§).

Copper exploration conducted by Oxiana at the Thengkham North and the Thengkham South deposits during 2004 and 2005 resulted in the discovery of additional resources of about 29.4 Mt of ore at a grade of 1.5% copper at the Thengkham North deposit and about 25 Mt of ore at a grade of 1.3% copper at the Thengkham South deposit. The resources at the Khanong deposit, predominantly a chalcocite ore body, were estimated to be 42 Mt of ore at a grade of 3.0% copper. In early 2005, the company made plans to expand its copper operation following the discovery of additional resources at the Thengkham North and the Thangkham South deposits and initiated a study in the third quarter of 2005 to assess the feasibility of copper plant expansion (Oxiana Ltd., 2005a§, c§).

Pan Australian Resources, which was expected to become the second copper producer in Laos, appointed Ausenco Ltd. as lead consultant to conduct the full bankable feasibility study for its Phu Kham copper-gold project in December 2004. The infill drill program conducted by the company in the central area of the deposit supported a resource upgrade at the Phu Kham copper-gold project. The feasibility study, which was scheduled for completion in March 2006, was seeking to confirm the potential for the Phu Kham copper-gold project to support a 9-million-metric-ton-per-year (Mt/yr) flotation operation to produce an average of 50,000 t/yr of copper and 1,608 kilograms per year (kg/yr) of gold in a concentrate with total capital expenditures of about $195 million. As of October 2005,

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the Phu Kham copper-gold mineral resource was estimated to be 160.1 Mt at a grade of 0.66% copper and 0.29 g/t gold. Under Phu Kham Phase II, the Phu Kham copper-gold project was scheduled for commissioning at the end of 2007 and full production was expected to start in mid-2008 (Pan Australian Resources Ltd., 2005a§, c§; 2006§).

In 2005, gold mine production was mainly by Oxiana from its Sepon gold mine. In 2005, the Sepon Mine produced about 3.1 Mt of ore at a grade of 2.59 grams per metric ton (g/t) gold compared with 2.5 Mt at a grade of 3.01 g/t in 2004. The mill processed 2.66 Mt of ore at grades of 2.77 g/t gold and 4.99 g/t silver compared with 1.38 Mt of ore at grades of 3.77 g/t gold and 6.33 g/t silver in 2004. The recovery rate for gold and silver was 84.5% and 25.6%, respectively, in 2005, compared with 85.4% and 31.3%, respectively, in 2004. In 2005, the production of gold and silver from the Sepon gold mine was 6,232 kilograms (kg) (200,370 troy ounces) and 3,405 kg (109,460 troy ounces), respectively, compared with 4,392 kg (141,213 troy ounces) and 2,735 kg (87,920 troy ounces), respectively, in 2004. The total cash cost rose to $8,359 per kilogram ($260 per troy ounce) from $6,076 per kilogram ($189 per troy ounce) in 2004. The higher cash cost in 2005 was caused mainly by a temporary shutdown of SAG ball mill, lower gold recovery, and the higher cost of supplies. The total production costs (cash cost plus depreciation, depletion, amortization, and rehabilitation) rose to $11,092 per kilogram ($345 per troy ounce) from $9,034 per kilogram ($281 per troy ounce) in 2004 (Oxiana Ltd., 2005a§).

In December 2004, Oxiana reportedly had entered into an exploration joint venture with South Africa-based AngloGold Ashanti Ltd. (the world's second ranked producer of the precious metal) to explore for gold throughout Laos (AngloGold Ashanti Ltd., 2004§; Seven Corporate, 2005§). During 2005, Oxiana continued to carry out its Sepon gold exploration program at the Luang and the Discovery Main deposits and at the Ban Mai, the Houay Bang, the Kengkeuk, and the Pha Vat North Prospects. According to Oxiana, near mine exploration continued to confirm the potential for greater gold and copper resources, and its resource development drilling continued to find additional oxide resources in the Discovery West, the Nalou, and the Namkok West areas, which are located within 3 to 4 km of Oxiana's gold and copper plants (Oxiana Ltd., 2005a§).

Pan Australian Resources became the second Laotian gold producer in 2005 when the company poured gold from the Phu Bia heap leach mine on November 1, 2005. The gold production for the two months that ended on December 31, 2005, totaled 106.3 kg (3,418 troy ounces). According to Pan Australian Resources, the Phu Bia heap leach gold mine was on schedule to produce more than 1,900 kg (60,000 troy ounces) at cash costs of about $200 per ounce in 2006. At the Phu Bia heap leach gold mine (Phu Kham gold cap under the Phu Kham Phase I), the oxide mineral resource was estimated to be 12.8 Mt at a grade of 1.0 g/t gold, of which the oxide ore reserve was estimated to be 8.6 Mt at a grade of 1.1 g/t gold. The preproduction capital cost was $15.3 million. The company planned to mine 2 Mt of ore with a head grade of 1.5 g/t gold and a 90% recovery rate to produce about 1,900 kg (60,000 troy ounces) of gold in 2006 (Pan Australian Resources Ltd., 2006§).

In December 2005, Pan Australian Resources announced that it had completed acquisition of Newmount's 20% interest in Phu Bia Mining Ltd. for $5.3 million following approval of the share transfer by the Laotian Government. The Government had indicated that it will exercise its option to acquire a 10% interest in Phu Bia Mining. After the Government has exercised its option, Pan Australian Resources will own a 90% interest in Phu Bia Mining and thereby have a 90% interest in the Phu Bia gold mine and the Phu Kham copper-gold project (Pan Australian Resources Ltd., 2005b§).

First Pacific Mining Company, which signed a contract with the Laotian Government in 2003, reportedly started to mine and process lead and zinc at the Pha Luang Mine near Vang Vien, Vientiane Province, for export to China. In April 2005, Rox Resources Ltd. of Australia (a Perth-based exploration company) reached an agreement with First Pacific Mining (Laos) Company Ltd. to acquire a 60% interest in the sulfide portion of the Pha Luang lead-zinc and silver mine (Rox Resources Ltd., 2005b§). Rox Resources' exploration drillings started in June 2005 and were conducted in the Bon Noi, the Nam Yen, the Pha Luang 2, and the Pha Luang 3 prospects, which are located approximately160 km north of Vientiane. According to Rox Resources' Managing Director, the returned results indicated that the Pha Luang has potential to host a significant lead-zinc ore body. In September 2005, Rox Resources planned aggressive exploration programs at the Bon Noi and the Nam Yen prospects. Additional exploration was to be conducted from December 2005 to May 2006 (Rox Resources Ltd., 2005a§).

During the next 3 years, the mining sector is expected to expand considerably. Oxiana is expected to increase its copper and gold production capacity at its Khanong copper mine. Production capacities for copper and gold could be boosted by Pan Australian Resources if the development of the Phu Kham copper-gold project and the Phu Bia gold project are completed and come onstream by 2008. During the next 5 to 6 years, Chinese investment potential in the mining sector may include potash production in Vientiane, development of iron ore deposits in Xiengkhuang Province, and planned hydroelectric power development in the Nam Ngum River northeast of Vientiane in Xiengkhuang Province.

The World Bank reportedly had approved financing support for a $1.2 billion dam project in April 2005. The power generated from the Nam Theum 2 Dam would be sold to Thailand and the revenues would be used for education, health, and other antipoverty initiatives. The project would be funded by $855 million in loans and by $330 million in equity from shareholders, which included the Laotian Government and companies from France and Thailand. According to The Wall Street Journal, the World Bank was expected to provide a $20 million grant, a $50 million loan, a partial risk guarantee, and a $200 million Multilateral Investment Guarantee Agency loan guarantee. Other multilateral organizations also were expected to assist the project (Wall Street Journal, The, 2005).

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The Laotian economy was expected to grow by 7% in 2006 (International Monetary Fund, 2005§). The economy will expand further if the country's mining sector increases its contribution to the country's GDP through increased production and exports of copper, gold, silver, and zinc during the next 3 to 4 years.

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TABLE 1
CAMBODIA AND LAOS: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Country and commodity		2001	2002	2003	2004	2005[e]
CAMBODIA[2]						
Gravel		1,880	9,800	13,800	-- [r]	--
Laterite, blocks		42,800	381,400	240,700 [r]	118,400 [r]	200,000
Phosphate fertilizer		900	115	--	--	--
Quartz sand		5,050	--	1,000	--	--
Salt		11,000	72,500	36,000	40,000 [e]	40,000
Sand, construction materials		563,860	505,960	248,400 [r]	358,700 [r]	400,000
Stones, crude construction materials		280,740	642,500 [r]	786,100 [r]	501,600 [r]	600,000
LAOS[3]						
Barite		3,300 [r]	12,695	18,070	10,470 [r]	15,000
Cement[e]		92,000	240,000	250,000	250,000	350,000
Clay		41,577	117,572	51,866	58,718	60,000
Coal, lignite		177,106 [r]	233,923	212,819	298,761 [r]	300,000
Copper, refined		--	--	--	--	30,480 [4]
Gemstones, sapphire	carats	532,494	833,984	2,302,973	712,320 [r]	800,000
Gold	kilograms	--	--	5,368	4,392 [r]	6,338 [4]
Gravel		331,200	559,000	549,300	98,900	120,000
Gypsum		121,220	110,272	101,727	244,145 [r]	250,000
Limestone		472,652 [r]	1,315,140	379,000	518,000	560,000
Salt, rock		2,635	5,410	16,130	15,000 [e]	15,000
Sand, construction materials		331,200	559,000	549,300	98,900	100,000
Silver	kilograms	--	--	3,850	2,735 [r]	3,405 [4]
Tin, mine output, Sn content[e]		490	366	360	400 [r]	450
Zinc, mine output, Zn content[e]		9,310	370	850	950 [r]	1,100

[e]Estimated; estimated data are rounded to no more than three significant digits. [r]Revised. -- Zero.

[1]Table includes data available through March 24, 2006.

[2]In addition to the commodities listed, clay, gemstones, gold, iron ore, and lime are presumably produced, but available information is inadequate to make reliable estimates of output levels.

[3]In addition to the commodities listed, crude construction materials, such as sand and gravel, and varieties of stone were produced irregularly.

[4]Reported figure.

Sources: Cambodia's Ministry of Industry, Mines and Energy; Laos' Ministry of Industry and Handicraft, Lao PDR 2004 Mineral Yearbook; U.S. Geological Survey Minerals Questionnaires for Cambodia (2002-04) and Laos (2002-03); Oxiana Ltd. Annual Report 2004 and Quarterly Reports 2004-05; Pan Australian Resources Ltd., Quarterly Reports 2005.

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THE MINERAL INDUSTRY OF CHINA

By Pui-Kwan Tse

During the past two decades, China had achieved remarkable economic growth. The gross domestic product (GDP) increased by 9.9% to $2.26 trillion, and the per capita GDP rose to $1,728 in 2005. The 2005 economic growth rate was 0.2% lower than that of the revised 2004 economic growth rate. Most of the upward adjustment of the GDP to 10.1% for 2004 was the result of the omission of millions of mostly private service companies. The 2004 economic census indicated that these services were more important to the country's economy than previously thought. During the past 5 years, China's economy grew by more than 9% per year. The strong economic growth was aided by increased domestic investment and export-oriented industrial production. By the end of 2005, China's foreign exchange reserves reached $818.9 billion. The output of the industrial sector increased by 11.4% compared with the previous year. Fixed asset investment grew by 25.7% to $1.09 trillion. Of the total investment, state-owned and state-holding enterprises accounted for 45.5%, or $496 billion. Investments in the coal and the oil sectors increased by 65.6% and 29.7%, respectively. Despite strong economic expansion, consumer inflation increased by only 1.8% in 2005. Food prices rose only slightly, and productivity improvements helped to offset the rising costs of production of materials and labor. In 2005, average global oil prices increased by 40%. Owing to Government price controls, however, the prices of petroleum products in China increased by only between 10% and 15%. Oil refiners in China posted heavy losses, and the Government paid China Petrochemical Corp. (Sinopec) $1.2 billion in compensation (State Statistics Bureau, 2006).

Government Policies and Programs

The Millennium Development Goals for China was established to develop a "Xiaokang" (the all-around moderately prosperous society) with emphasis on a "Harmonious Socialist Society." The Government's outline of the Eleventh 5-Year Plan (2006-2010) describes plans for more-balanced growth in urban and rural areas and more-equitable income distribution. It introduces two basic policies for saving natural resources and protecting the environment. In the plan, the Government expects the per capita GDP to be double that of 2000 by 2010. The plan also focuses on improving agricultural productivity, infrastructure, and service delivery. Other important objectives noted in the plan include reducing production and transportation costs; upgrading technological processes; improving energy development; and adjusting the raw material supply infrastructure in China. The plan also describes the Government's plans to merge and/or take over small coal mines to form big mining companies during the next several years to improve production efficiency and safety. It stresses the importance of upgrading the iron and steel sector through mergers, improving the quality of steel products, and controlling the production capacities of 13 commodities, including aluminum, cement, copper, iron and steel, lead, and zinc (Zhonghua Reminn Gongheguo Guowuyuan Gongbao, 2006).

In 2005, the National Development and Reform Commission (NDRC) urged the consolidation of the aluminum, automotive, cement, and iron and steel sectors where capacity growth appeared excessive and encouraged companies to explore for and develop facilities to produce copper, lead, manganese, and zinc in China and overseas. The Government continued to control strictly the development of antimony, rare earths, tin, and tungsten, and foreign investors were not allowed to participate in the exploration and exploitation of these commodities (China Nonferrous Metals News, 2005b; Zhonghua Reminn Gongheguo Guowuyuan Gongbao, 2006).

Even though the Government took steps to "cool down" the strong growth sectors that the Government considered to be "overheated," such as aluminum, automobiles, cement, real estate, and steel, China's economy continued to expand at a rapid pace. Fixed asset investments in large public works projects, factory construction, and commercial real estate development, especially in the urban areas, increased by more than 20%. The Government was concerned that the new waves of investment in the production capacities of the automobile, cement, and steel sectors could diminish prices. During the past decade, the Government had tried gradually to restrain its economy without jeopardizing the creation of jobs for millions of farmers and the younger generation. During the past 2 years, the rising prices of such commodities as coal and iron ore in the world markets led to financial losses for many domestic ferrous and nonferrous metal producers. In response, the Government ordered banks and local governments once again to tighten financing for construction projects. To cool real estate speculation, the People's Bank of China (Central Bank) raised the minimum required downpayment for the purchase of an apartment, increased the interest rate to 5.85%, and introduced a new capital gains tax on properties sold within 5 years of purchase. These measures were designed to contain the desire of local governments to invest in more infrastructure and to prevent banks from over-lending and thereby avoid medium- and long-term bad debts (Citigroup Global Market Inc., 2006; Goodman, 2006b).

During the past two decades, China's economic growth has been led by investment and export growth. The next engine for China's economic growth was expected to be domestic consumption growth. The high saving rate of China's households was associated with a weak social security system and absence of investment opportunities. The relatively low consumption ratio was one of the factors in the country's widening trade surplus and increasing foreign exchange reserves. The Eleventh 5-Year Plan proposes to rebalance consumption and investment, and domestic and external demand. The Central Bank revealed that a futures trading act would be introduced to protect investors in the commodity futures and financial derivatives markets. During the past

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several years, the Government has spent more than $600 billion to cover nonperforming loans created by domestic financial institutions. Private economists estimated that as much as $500 billion in nonperforming loans remained in the current accounts of China's banks. The Government planned to establish a mechanism to close loss-making institutions and halt buyouts by the Government, but regulations covering the obligations and rights of shareholders were vague. Because the liquidation procedure for banks was difficult to implement, the Central Bank also submitted a proposal to the State Council to establish a deposit insurance system in China (Asian Development Bank, 2006, p. 118; China Nonferrous Metals News, 2006; Goodman, 2006a).

China's mineral resources law was enacted in 1986 and amended in 1996. The Government believed that the law needed to be amended again to attract foreign investment in mineral development and production in China. The proposed changes may redefine mineral rights. In the 1986 and 1996 versions, all minerals above and under the surface belonged to and were controlled by the State. In 2000, the State Council issued a decree to allow foreign investors to establish wholly-owned mining companies to prospect for and exploit minerals in China; owing to the lack of clarity in regulations and legal definitions, however, exploration companies were reluctant to invest large amounts in China. Under the current law as amended in 1996, prospectors have mining rights, but the law does not explain clearly how such rights can be guaranteed. In 2003, the Ministry of Land and Resources (MLR) established a mineral-resources law consultation committee to seek recommendations from domestic and overseas mining law experts. In 2005, a multinational mining consortium that included BHP Billiton plc and Rio Tinto Group began working with the Chinese Government to revise the country's mineral resources law for foreign investors (Interfax Information Services, 2006f).

The Government established an energy law leadership group composed of representatives from 15 Government agencies to draft a new energy law. The proposed new law would close legislative gaps among existing regulations and laws, such as the Coal Law, the Electric Power Law, the Energy Conservation Law, and the Renewable Energy Law and would stress energy efficiency and environmental protection. It also would strengthen implementation of the country's energy strategy and energy security. The group planned to finish drafting the new law within the next 2 years (Interfax Information Services, 2006b).

The MLR planned to build as many as 10 strategic mineral reserves, including reserves of aluminum, copper, manganese, uranium, and other minerals that the country urgently needed. The Government began to build four crude oil strategic reserve sites; the first one was expected to be completed in 2006. The Government did not review the reserve levels and who might manage them. The State Reserve Bureau handled the country's commodity stockpile and lost millions of dollars on copper trading in the global markets in 2005. The initial review indicated that the Government would hold 200 million metric tons (Mt) of bauxite and copper metal each, 100 billion metric tons (Gt) of coal, and 5 Gt of crude oil (Washington Post, The, 2006).

Production

Since the country's opening to the world in 1978, China's rapid economic growth has resulted in strong demand for a wide variety of mineral commodities. During the same period, China's mineral production increased sharply. China's increased mineral production and demand affected the worldwide availability of minerals and metals, the market prices, and trade. The rapid increases in production capacities within China have outstripped China's domestic demand for such commodities as aluminum and iron and steel. To sustain development of such commodities as chromium, cobalt, copper, iron, lead, nickel and zinc, in which China was deficient, the Government urged Chinese companies to invest through joint ventures in such areas as Africa, Latin America, the Pacific region, and Southeast Asia, which are rich in mineral resources.

Despite the Government's macroeconomic policy to control overheated commodities, the output of aluminum metal continued to increase rapidly. Since 2003, the Government has not approved any new projects, and 43 smelters were shut down during the past 2 years. The country's installed aluminum output capacity increased to about 10.7 Mt at yearend 2005 from about 9.4 Mt at yearend 2004 because many new or expansion projects were approved by the Government before 2003. In September 2005, the State Council issued a development policy in principle for the aluminum sector and assigned NDRC to work with relevant agencies to prepare a sustainable aluminum development plan. According to the NDRC report, the utilization rate of China's aluminum smelters was between 75% and 78% in 2005. In 2005, 11 aluminum projects were under construction with a total designed output capacity of 1.12 Mt. An additional 10 aluminum projects were in feasibility study stage with a total designed output capacity of 1.40 Mt (China Nonferrous Metals News, 2005c; State Council, 2005; National Development and Reform Commission, 2006a).

With the rapid increase of aluminum production, the ability of producers of domestic bauxite and alumina to meet demand will be much more difficult. The Government set as a priority the development of alumina refineries and fabricating products for the aerospace, construction, packaging, power, and transportation sectors. During the past several years, companies submitted 11 alumina expansion and greenfield plans to the Government for approval with a total output capacity of 12.15 Mt and a total investment of $6.8 billion. About one-half of the submitted output capacity was under construction by such companies as Chongqing Bosai Minerals Group Co. Ltd., Guixi Huayin Aluminum Co. Ltd., Henan Zhongmei Aluminum Co. Ltd., Luneng Jinbei Aluminum Co. Ltd., Shandong Nanshan Group, and Shanxi Wusheng Aluminum Co. Ltd. China's total alumina output capacity was expected to increase to 14 Mt in 2010 from 10.7 Mt in 2005. Domestic analysts believed that the alumina output capacity could be higher than the Government's report in 2010 (China Nonferrous Metals News, 2005c; National Development and Reform Commission, 2006a).

China was the leading antimony producer in the world and accounted for more than 70% of the world total. Antimony resources in the Provinces of Gansu, Guangxi, Guizhou, Hunan, Jiangxi, and Yunnan accounted for more than 80% of China's

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total. Before 2001, Guangxi Zhuang Autonomous Region was the country's leading antimony producing province. Owing to excess extraction during the past decade, antimony resources in Guangxi Zhuang Autonomous Region declined sharply, and Hunan Province became the leading antimony producing province. The quantity of antimony output and export from China affected the price of antimony in world markets. During the past 3 years, the output of China's antimony metal was more than 100,000 metric tons per year (t/yr); according to statistical data, however, the output of antimony mines was much lower than antimony metal output. China imported 21,924 metric tons (t) of antimony concentrates in 2005 compared with 17,984 t in 2004. Antimony concentrates were imported mainly from, in descending order, Russia, Kazakhstan, Tajikistan, Burma, and Bolivia. Even if imports of antimony concentrates are included, the total supply of antimony concentrates was still less than the quantity that was required to produce the estimated antimony metal output. Thus, although some antimony metal may be produced from scrap, some illegal antimony mining activity probably still takes place in China. Antimony concentrates output from the Provinces of Hunan and Guangxi accounted for 54% and 34%, respectively, of the country's total. Hunan Province was the leading antimony metal producing province followed by Guangxi Zhuang Autonomous Region and Yunnan Province; they accounted for 59%, 20% and 10%, respectively, of the country's total (China Metal Bulletin, 2006c).

Owing to domestic smelter and refinery expansions, China's copper output increased sharply during the past several years. China's leading copper producers planned to continue their output capacity expansions in the next several years. At yearend 2004, China's copper smelting capacity was 1.63 Mt, and its refining capacity was 2.20 Mt. According to the NDRC survey, 18 copper smelting projects were under construction or in planning stages for a total design output capacity of 2.06 Mt in 2005. The country's refined copper output was expected to reach 3.70 Mt in 2007. During the past several years, copper consumption in China increased by an average of more than 10% per year. The increase in copper consumption was caused by increased demand from the construction, electrical appliance, and power sectors. The power sector accounted for about 50% of the total copper consumption, and the demand was expected to continue to increase in the next several years because of the expansion of electricity supply throughout the country. In 2005, China's refined copper consumption was estimated to be 3.80 Mt and was expected to increase to more than 4.50 Mt in 2010 (China Metal Bulletin, 2006d).

The Asia and the Pacific region produced and consumed more than 50% of the world's total crude steel production in 2005, and China was the major driver. In 2005, the world's crude steel production increased by 5.9% compared with that of 2004. Excluding China, the world crude steel output decreased by 0.1%. During each of the past 3 years, China's crude steel output increased by more than 10%. The continuous expansion in the iron and steel sector was generated mainly by strong domestic demand. The demand for steel products from such sectors as automobile, infrastructure, real estate, and shipbuilding has increased rapidly during the past several years. Steel producers were not only expanding the iron and steel output from their old facilities, but also building new plants in other locations; Anshan Iron and Steel (Group) Co. (Angang) and Shoudu Iron and Steel (Group) Co. (Shougang), for example, relocated their plants to coastal areas to gain easy access to iron ore imports. NDRC stated that China had a crude steel output capacity of 470 Mt in 2005, that 70 Mt of new capacity was being built, and that 80 Mt was planned. According to the iron and steel restructuring plan approved by the State Council, steel companies will retire all blast furnaces smaller than 300 cubic meters and converters less than 20 t. Blast furnaces that do not meet environmental and power consumption standards were to be banned. Companies were not allowed to import obsolete used steel equipment. During the Eleventh 5-Year Plan period, China will retire a total of 100 million metric tons per year (Mt/yr) of pig iron and 55 Mt/yr of crude steel output capacities (China Economic News, 2005b; Mining Journal, 2006).

China was the world's leading producer of lead and zinc, and its production of both lead and zinc metal continued to increase in 2005. The shortage of concentrates in China forced lead and zinc metal producers to increase their reliance on imported raw materials and was expected to continue in the future. China's lead concentrate imports increased to 1,030,160 t in 2005 from 830,560 t in 2004. In 2005, China's apparent consumption increased to about 1.90 Mt of refined lead, of which consumption by the battery sector accounted for about 78%. Lead battery demand was expected to continue in the future because the Beijing City government removed the restriction on the use of electric bicycles in the city in January 2006 and because of the increase in automotive production in China. Because production exceeded consumption, China was a net refined lead exporting country. In 2005, the country exported 455,041 t of refined lead mainly to the Republic of Korea and Taiwan. According to the State Council guidelines, the Government would not approve any lead smelting project with a designed output capacity of less than 50,000 t/yr and any secondary refined lead project of less than 10,000 t/yr. Owing to the increase in domestic consumption, the export volume of refined lead from China was expected to decline in the future (National Development and Reform Commission, 2005b; Lead, Zinc, and Tin Monthly, 2006b).

Owing to the shortage of concentrates and power supply, environmental issues, and transportation problems, the production rate for zinc metal increased only slightly in 2005 compared with larger increases during the previous several years. Even though prices of zinc metal increased in the domestic and international markets, zinc smelters in Guangxi Zhuangzu Autonomous Region reduced their output because of the low treatment charge/refining charge (TC/RC) on imported concentrates and a shortage of electricity in the area. Other provinces, such as Henan, Shanxi, and Yunnan, increased their output because of smelter expansion and a reliable supply of domestic concentrates. About 380,000 t/yr of additional zinc metal output capacity was put into operation, which gave China a zinc metal output capacity of more than 3 Mt at yearend 2005. Domestic analysts expected that an additional 160,000 t/yr of zinc smelting capacity would be put into operation in 2006. In 2005, owing to low TC/RC, imports of zinc concentrates decreased by 7.8% to 567,752 t; companies turned to imported

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zinc metal and, as a result, imports of refined zinc increased by 63.8% to 392,221 t. Besides increasing domestic demand, the price difference between the domestic and international markets was another reason for increased imports. Also, the Government reduced the export value-added-tax (VAT) rebate to 8% in 2005 from 11% in 2004 and 15% in 2003. Imports of zinc concentrates were mainly from Australia, India, and Iran. China consumed about 3.0 Mt of zinc in 2005, and the demand for zinc was expected to increase in 2006 because of the construction of power-generating facilities and the expansion of galvanized steel production (Lead, Zinc, and Tin Monthly, 2006c).

Trade

According to the customs statistics, total trade was valued at $1.42 trillion in 2005; this was an increase of 23.2% compared with that of 2004. Exports posted an increase of 28.4% to $762.0 billion, and imports went up by 28.4% to $660.1 billion. The United States remained the leading destination for China's exports followed by the European Union (EU), Hong Kong, and Japan. Japan was China's leading source of imports followed by the Republic of Korea and the EU. Owing to rising incomes, the spur in demand for foreign goods—especially in the technology sector—and the depreciation of its currency against the United States dollar, China's trade surplus gap was expected to be narrower in the coming years. Imports of raw materials, such as alumina, chromium ore, copper concentrates, iron ore, manganese ore, potassium fertilizer, and oil, increased sharply. Owing to increased domestic demand and transportation bottlenecks, imports of coke, coal, and steel products increased. In 2005, the total trade of minerals and metals increased to more than $300 billion (General Administration of Customs of the People's Republic of China, 2005, p. 2-63).

The Ministry of Commerce (MOC) issued circular No. 50, which included a list of commodities that were banned for processing trade. Mineral commodities that were on the Government's monitor list were ammonium paratungstate; bauxite and refractory clay; coal; coke; concentrates of antimony, tin, tungsten, and zinc; fluorspar; oxides of antimony, magnesium, and tungsten; platinum; rare earths; silicon carbide; silver; talc; and unwrought and alloys of antimony, tin, and zinc. Beginning on January 1, 2006, copper concentrate and scrap tolling trade were to be subject to a 13% and 17% VAT, respectively. All antimony products would be required to be registered and exported through the Ports of Beihai in Guangxi Zhuangzu Autonomous Region, Huangpo in Guangdong Province, and Tianjin City. The Port of Dalian in Liaoning Province was designated as the port to issue export licenses for magnesia, which could be exported through the Ports of Changchun in Jilin Province, Dalian, Manshouli in Heilongjiang Province, and Qingdao in Shandong Province. The Government adjusted the 2006 export quota for coal to 80 Mt; coke, 14 Mt; oil products, 9 Mt; magnesia, 1.36 Mt; crude oil, 1 Mt; fluorspar, 710,000 t; talc, 635,000 t; zinc and zinc products (metal content), 520,000 t; silicon carbide, 223,000 t; antimony and antimony products (metal content), 63,700 t; tin and tin products (metal content), 53,000 t; rare earths (rare-earth oxide equivalent), 45,000 t; tungsten and tungsten products (metal content), 15,800 t; and silver, 4,000 t. MOC also issued guidelines for enterprises that had the right to supply and export antimony, coke, rare earths, silver, and tungsten. The import quota for ammonium phosphoric acid was set at 6.90 Mt; complex fertilizer, 3.45 Mt, and urea, 3.30 Mt. Within the quota quantity, the import tariff rate would be 4%; otherwise, the import tariff rate would be 50%. Of the total imported volume, 4.49 Mt of ammonium phosphoric acid, 2.24 Mt of complex fertilizer, and 2.97 Mt of urea were assigned to state-owned enterprises (Ministry of Commerce, 2005a-f).

With the approval of the State Council, the Ministry of Finance revoked the VAT export rebate on aluminum and aluminum alloys, ferroalloys, nickel, phosphorus, and silicon carbide and imposed a 5% export tax on aluminum metal and refined copper and a 2% export tax on refined nickel beginning on January 1, 2005. The tariff rate for aluminum scrap and waste, and copper anode, scrap, and waste was levied at 10%. Beginning on April 1, 2006, the export tax on copper and copper alloy was to be increased to 10% from 5%, and on copper fabricated products, to 10% from 0%. Starting on May 1, 2005, the VAT export rebate on products of antimony, coal, tin, tungsten, and zinc was reduced to 8%. In the future, the VAT export rebate on fluorspar, magnesia, molybdenum concentrates, rare-earth products, silicon metal, and talc would be reduced to zero. The VAT export rebate on magnesium would be decreased to 5% from 13% and that on products of antimony, coal, tin, tungsten, and zinc would be reduced further to 5% beginning on January 1, 2006. The export tax rate on yellow phosphorus would be increased to 20% from 10%, and ferrosilicon, to 5% from 0% (Ministry of Finance, 2005; China Nonferrous Metals Monthly, 2006d).

Commodity Review

Metals

Aluminum.—During the past decade, owing to an increase in consumption and a high metal price, China's aluminum producers expanded their aluminum output at a rapid pace. The ability of domestic aluminum refineries to meet the domestic demand for alumina by aluminum smelters became more difficult in recent years and affected domestic and international market prices of alumina. China's sole metallurgical-grade alumina producer, Aluminum Corporation of China (Chinalco), increased the alumina price to 5,200 yuan per metric ton ($650 per metric ton) in December from 4,300 yuan per metric ton ($537 per metric ton) in January. Owing to increased prices for alumina and fuel, many aluminum producers faced financial loss. At the end of November 2005, 43 aluminum smelters were closed, and 23 domestic aluminum producers announced a reduction of aluminum output by 10% for December 2005. Prices of alumina and aluminum were expected to affect the implementation of the production reduction plan for these smelters. In 2005, China imported about 7.0 Mt of alumina mainly from Australia and India. In 2006, China's alumina imports were expected to be about the same or less than that of 2005 because several aluminum refineries were expected to be put into operation and because the Government was

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continuing its effort to control the expansion of output capacity at domestic aluminum smelters. China's alumina demand was predicted to reach 18.5 Mt and domestic alumina supply, about 12 Mt, in 2006. The slowdown of the country's alumina imports would have some impact on the alumina prices in domestic and international markets (Alumina and Aluminum Monthly, 2006c).

Before 2004, the consumption and production of bauxite was nearly balanced. China's bauxite resources were located mainly in the Provinces of Guangxi, Guizhou, Henan, and Shanxi. With limited bauxite resources in Shandong Province, such aluminum refineries as Shandong Aluminum Plant and Shandong Chiping Xinfa Aluminum and Electricity Group needed to import bauxite from overseas. In 2005, China imported 2.17 Mt of bauxite mainly from Australia and Indonesia (Alumina and Aluminum Monthly, 2006b, c).

During the past 2 years, with Government support, Chinalco's subsidiary Aluminum Corporation of China Ltd. (Chalco), which was listed on the Hong Kong Stock Exchange, actively acquired local aluminum producers. Chalco acquired major shares of Baotou Aluminum Plant in Nei Mongol Autonomous Region; Fushun Aluminum Plant in Liaoning Province; Guangyuan Qimingxing Aluminum Co. Ltd. in Sichuan Province; Shanxi Guanlu Co. Ltd.'s Huasheng Aluminum Plant in Shanxi Province; Jiaozuo Wanfang Aluminum Co. Ltd. and Henan Zhongmai Aluminum Co. Ltd. in Henan Province; Baiyin Honglu Aluminum Co., Lanzhou Aluminum Plant, and Liancheng Aluminum Plant in Gansu Province; and Zunyi Aluminum Co. in Guizhou Province. Chalco was also interested in purchasing shares of Baihe Aluminum Co. and Qinghai West Mining Co. Ltd. in Qinghai Province, Huamao Aluminum Plant and Qin'ao Aluminum Co. in Henan Province, and Shandong Huashen Jiangquan Aluminum Co. Ltd. in Shandong Province. Chalco proposed issuing up to 5 billion yuan ($625 million) of short-term corporate bonds in 2006 to finance its aluminum projects in the Provinces of Guizhou, Henan, and Shanxi. Chinalco diversified its business into other sectors and formed a joint venture with Luoyang Copper Co. Ltd. in 2005 and acquired Daye Nonferrous Metals Co. Ltd. from the Hebei Provincial government. Chalco signed a memorandum of understanding with Charcoal Group of Vietnam to jointly develop bauxite resources and to build an integrated power-aluminum project in Dak Nong, Vietnam, and submitted a bid to the government of Queensland to develop a bauxite mine in Aurukun, Australia. Chinalco signed an initial agreement with the state-owned Assets Supervision and Management Committee of Shanghai to acquire the assets of the Shanghai Nonferrous Group, which was the leading copper semimanufacturing company in Shanghai. Chinalco planned to have total output capacities of 12 Mt/yr of alumina and 5 Mt/yr of aluminum from its subsidiaries by 2010 (China Nonferrous Metals News, 2005a; China Metals 2006a; China Nonferrous Metals Monthly, 2006a).

Yunnan Metallurgy Corp., a parent company of Yunnan Aluminum Plant, signed a cooperation agreement with the government of Wenshan Zhuang and Miao Autonomous Prefecture to jointly develop bauxite resources in Wenshan, Yunnan Province, where 33.85 Mt of high-grade aluminum oxide was located. The plan was to build a bauxite mine and a greenfield aluminum refinery with a designed output capacity of 800,000 t/yr of alumina. The construction of the refinery was scheduled to begin in the second-half of 2006 and to be completed in 2008 (Alumina and Aluminum Monthly, 2006d).

China was one of the major aluminum scrap importing countries in the world. During the past several years, China's aluminum scrap imports grew by more than 10%. China imported 1.69 Mt of aluminum scrap in 2005 compared with 1.2 Mt in 2004, mainly from the United States. During 2004-05, prices of domestic primary aluminum were higher than aluminum scrap; therefore, aluminum fabricating producers increased their imports of scrap. Because the Government imposed a 5% export tax on aluminum and reduced the VAT rebate to zero, the volume of aluminum exports decreased to 427,473 t in 2005 from 698,039 t in 2004. Also, the exchange rate of the renmenbi against the United States dollar appreciated in July 2005. This led to aluminum fabricating producers using more domestic aluminum. If this trend continues, China is expected to import less aluminum scrap in the future (Alumina and Aluminum Monthly, 2006a).

Cobalt.—Despite having limited cobalt resources, China—which was one of the leading mobile phone producers in the world—continued to expand its refined cobalt output capacity during the past several years. The demand for cobalt batteries has been the driving force behind the rapid expansion of cobalt-refining facilities in China. The Jinchuan Nonferrous Group expanded its refined cobalt products output capacity to 6,000 t/yr at yearend 2005 and planned to increase it to 8,000 t/yr in 2010.

In 2005, the country produced about 16,000 t of cobalt products from its total output capacity of 25,000 t/yr. The Jinchuan Nonferrous Group produced about 4,500 t (metal content) of cobalt products, of which refined cobalt and tricobalt tetraoxide were two main products. The country consumed about 10,000 of cobalt. The battery sector accounted for 50% of this total, followed by the glazing sector, 13%; cemented carbide, 10%; magnetic, 9%; and others, 18%. Owing to increased demand from cobalt salt producers, China cobalt concentrates imports increased to 199,146 t in 2005 from 143,594 t in 2004; the Democratic Republic of the Congo accounted for 90% of the total imports.

Future consumption of cobalt by the battery sector is expected to increase moderately compared with previous years. Consumption by the glazing sector is expected to grow even faster. China cobalt producers are planning to invest in cobalt production facilities in the Democratic of the Congo to secure raw materials for their production facilities in China (Precious and Minor Metals Monthly, 2006).

Copper.—During the past decade, the demand for copper in China increased rapidly and copper producers expanded their output capacities to meet the needs. China has limited copper resources and depended on imports to meet the gap between production and consumption. In 2005, China imported 4.06 Mt of copper concentrates, which was an increase of 41% from the previous year. Imports of blister copper also increased by 13% to 129,245 t, and those of copper scrap rose by 22% to 4.82 Mt. During the past 5 years, imports of refined copper grew at

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an average rate of 17% per year. Because of the expansion of output capacity, imports of refined copper grew by only 1.8% to 1.22 Mt in 2005 compared with that of 2004. During the next 3 years, more than 1 Mt/yr of copper smelting and refining output capacity will be added to the existing facilities of China's leading copper producers—Baiyin Nonferrous Metals Co., Daye Nonferrous Metals Co., Huludao Copper Smelter, Jiangxi Copper Co. Ltd., Tongling Nonferrous Metals Co., and Yunnan Copper Co. Ltd. Fujian Zijin Mining and Shandong Yanggu Xiangguang Copper Co. Ltd will put their greenfield plants into operation in the next 3 years.

According the NDRC report, the country's total copper smelting capacity will reach 5 Mt/yr by 2010. The rapid expansion of copper output capacity led the Government to issue guidelines strictly controlling investment in copper smelting and refining capacity. According to the regulation, all greenfield or brownfield projects must have a larger than 100,000-t/yr output capacity, and each enterprise is required to supply at least 25% of its total required copper concentrates from its own mines. The regulation requires each enterprise to provide at least 35% of the total investment from its own capital funds. The plant must adopt advanced and energy-saving technology. The regulation bans coal-fired reverberatory furnaces and blast furnaces for new projects. Existing reverberatory furnaces and electric arc furnaces are to be phased out by 2006 and blast furnaces will be shut down completely by 2007. NDRC will monitor the development closely (China Nonferrous Metals Monthly, 2006b).

Yunnan Copper Industry Group Co. announced its 5-year plan (2006-10). The company planned to expand its copper refining output capacity to 600,000 t/yr by 2010 from 350,000 t/yr in 2005. Between 2006 and 2008, the company intended to increase its existing refining capacity to 500,000 t/yr in Yunnan and to build a new 100,000-t/yr plant in Chifeng, Nei Mongol Autonomous Region. The company's smelting capacity will increase to 250,000 t/yr by 2010 from 200,000 t/yr in 2005. By 2010, Yunnan Copper will have an annual output capacity of 750,000 t of sulfuric acid, 600,000 t of copper, 850 t of silver, and 12 t of gold. The total investment was estimated to be about $400 million, of which about $275 million came from the company's capital fund, and the remaining, from bonds. Yunnan Copper also planned to invest $950 million in the next 5 years to explore for and exploit copper resources in China and overseas. The company's goal was to produce between 300,000 t and 400,000 t of copper in concentrates by 2010 to support the downstream operations. Several exploration and exploitation projects, such as Pulang, Simao Dapinzhang, and Yangla, were underway in China (China Metals, 2006f).

The NDRC approved the signing of a letter of intent by the joint venture of Norddeutsche Affinerie of Germany, Shandong Fengxiang Corp., and Shandong Yanggu Xiangguang Co. Ltd. to build a greenfield copper plant at Yanggu County, Shandong Province. The project was designed to produce 400,000 t/yr of copper cathode and 200,000 t/yr of copper wire. The first-phase construction of the plant, which used the Outokumpu smelting and refining technology, started in 2005 and was scheduled to be completed at the end of 2006. After the first phase is completed, the plant will have output capacities of 200,000 t/yr of copper cathode, 670,000 t/yr of sulfuric acid, 195 t/yr of silver, and 6.5 t/yr of gold. The plant was designed to use imported copper concentrates, and the company had secured long-term supply contracts with BHP Billiton and Minmetals Corp. The total investment for the project was to be $360 million, of which $180 million was a bank loan (Copper and Nickel Monthly, 2006).

Fujian Zijin Mining Group Co., Heilongjiang Provincial Mining Group Co., and Western Mining Co. Ltd. reached an agreement to form a company, Heilongjiang Duobaoshan Copper Mine Co., to develop the Duobaoshan copper deposit in Nenjiang County, Heilongjiang Province. The deposit had proven reserves of 2.97 Mt of copper and 110,000 t of molybdenum. Construction of the mine and dressing plant was scheduled to begin in May 2006, and total investment was to be $475 million (China Metals, 2005c).

Gold and Silver.—China was one of the leading producers of gold in the world. In 2005, the China Gold Association (CGA) reported that the country produced 224.05 t of gold and that gold mine producers produced 178.86 t; the National Statistics Bureau (NSB) indicated that gold output reached 325.30 t in 2005. The CGA might collect only production data on gold producers and large nonferrous metal producers, which could account for the difference between the CGA and the NSB data. China's gold ingot was produced from domestic and imported ore. Previously, gold output from gold mines accounted for about 80% of the total, and nonferrous metal mines accounted for 20%. In recent years, the production of nonferrous metal mines, such as copper, lead, and zinc, gradually increased; therefore, the share of gold production from these mines may have increased slightly. In the past several years, imports of copper, lead, and zinc concentrates increased. During the past decade, gold production in China increased gradually, and the trend toward increased output was expected to continue in the future. Shandong Province remained the leading gold producing province in China followed by the Provinces of Henan, Fujain, Liaoning, Shaanxi, and Hebei. During the past several years, the World Gold Council reported that China consumed between 200 and 250 t/yr of gold; domestic gold analysts, however, estimated that China consumed more than 300 t/yr. Owing to rapid economic development in China, demand for gold jewelry increased by more than 15% in 2005 compared with that of 2004. The gold production target for 2006 was 240 t. China's gold production was controlled by the Government and must be sold to the Government. Since 2002, gold producers could sell their gold through the Shanghai Gold Exchange (SGE), but exports and imports of gold ingot remained under Government control. The Government planned to set guidelines to allow selected metal producers to trade gold in the overseas markets. In 2005, SGE allowed individuals to participate in gold trading through the Industrial and Commercial Bank of China, and 906.42 t of gold was traded in the SGE. Gold trading at night was added in November. The SGE planned to add silver trading in 2006 (China Economic News, 2005a; China Metal Bulletin, 2006e)

The construction of the Lannigou gold mine was underway in 2005. The mine was operated by Sino Guizhou Jinfeng Mining Ltd., which was a subsidiary of Sino Gold Mining Ltd. The Lannigou gold mine is part of the Jinfeng gold prospect in the village of Niluo, which is located 34 km southeast of Mingu

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Township, Zhefeng County, Qianxianan Prefecture, Guizhou Province. The Jinfeng gold deposit was estimated to have 16.4 Mt of ore at a grade of 5.6 grams per metric ton (g/t) gold. About two-thirds of the total ore was proven reserves. The open pit Lannigou mine has proven reserves of 5.3 Mt of ore at a grade of 5.7 g/t gold. The mine was designed to have an output capacity of 1.8 Mt/yr of ore and to produce 9.6 t/yr of gold when it reached full capacity. The mine was scheduled to be completed in September 2006, with first gold production in December 2006 (Sino Gold Mining Ltd., 2006).

The leading gold producer in China, China Gold Group, signed an agreement with Jiangxi Geology Survey Bureau to acquire 50% of the Shiwu Gold Mine and the prospecting rights for the Zhulinxi deposit in the Jinshan gold prospecting area in Dexing City, Jiangxi Province. China Gold also discussed with the local government for China Gold to be the sole gold developer in the 60-square-kilometer Jinshan gold prospecting area. Currently, a local government-owned company, Damaoshan Mining Co. Ltd., processed 1,200 metric tons per day (t/d) of ore and produced about 1 t/yr of gold. Another local company, Huaqiao Mining Co., processed 700 t/d of ore and produced about 500 kilogram per year. About 200 t of gold reserves was estimated to be located in the Jinshan area. China Gold also signed an agreement with Jiangxi Copper and Jiangxi Provincial Mineral Resources Bureau to develop the Jinjiwo copper and silver deposit in Ruichang, Jiangxi Province. The joint-venture company Jiujiang Jinjiwo Mining Co. Ltd. was established. China Gold and Jiangxi Copper each held a 42.5% share in the joint-venture company. The construction of the mine was scheduled to start in 2006 and was expected to be completed in 2008 (Interfax Information Services, 2006e).

China's silver output was from silver mines; gold and silver mines; copper, lead, and zinc (polymetallic) mines; and scrap and waste. Silver from copper, lead, and zinc mines accounted for between 60% and 70% of the total. In 2003, when the Government decided to include secondary silver production in its industrial survey, silver output increased to 4,305 t in 2003, 6,087 t in 2004, and 7,196 t in 2005. Silver output from mines in China was estimated to be about 2,500 t in 2005. The Provinces of Hunan, Henan, Jiangxi, and Yunnan accounted for 67% of the total output. Yunnan Copper was the leading silver metal producer followed by Yugang Gold-Lead Co. Ltd., Yubei Metal Co., Jiangxi Copper, Ningxia Tianma Chemical Smelting Co. Ltd., Hunan Chenzhou Precious Metals Co., and Zhuzhou Nonferrous Metals Co. China's silver consumption increased to 2,600 t in 2005 from 2,300 t in 2004. Electronics accounted for 35% of the total consumption followed by photosensitive material, 20%; jewelry, 10%; and others, 15%. During the past 2 years, China became one of the leading silver exporting countries in the world. Unwrought silver accounted for more than 80% of total exports. Hong Kong was the leading destination followed by Thailand, India, and Australia (China Economic News, 2006b).

Iron and Steel.—To curb rolled-steel expansion and investment, the Government planned to abolish the export VAT rebate on slab and billet on April 1, 2005, and to reduce the export VAT rebate on other steel products to 11%; it planned to eliminate all steel product rebates in 2006. Output from the more than 300 integrated iron and steel enterprises and 1,500 steel producers in China and some of the steel products did not match the current demand. Only a small portion of China's steel products met the international standards. In July 2005, with the State Council approval, NDRC and eight other Government agencies published a new policy and guidelines on the development of the steel sector by 2010. The new policy encouraged iron and steel enterprises to consolidate through mergers and acquisitions so that two or three enterprises would have an output capacity of more than 30 Mt/yr. Only two steel producers had output capacities of more than 10 Mt/yr in 2003, but in 2005, eight steel producers had output capacities of more than 10 Mt/yr. Capacity expansion through technical renovation of existing facilities or relocation was encouraged. In 2005, China's 10 leading steel producers produced about 36.89% of the country's total steel output, and the Government set a target that these companies would produce more than 50% of the steel output by 2010 and 70% by 2020. The Government does not allow foreign investors to hold majority interests in steel companies in China. Local governments and departments were ordered to approve land use and financial loans only to those iron and steel enterprises that met the energy, environmental, technology, and water supply guidelines. The Government had approved the construction of several steel bases in the coastal Provinces in the east and south. The new guidelines will have a significant impact on global raw material markets in the future (China Metals, 2005b; National Development and Reform Commission, 2005a, 2006d).

China's steel was produced through two main processing routes—integrated and steel scrap. The integrated route accounted for about 85% of the country's total steel output. During the past 5 years, China's steel production increased by more than 10%; domestic iron ore production, however, could not meet internal demand. China depended on iron ore imports to fill the gap. In 2005, China imported more than 275 Mt of iron ore mainly from, in descending order of amount imported, Australia, India, Brazil, South Africa, and Russia. During the past 4 years, domestic iron ore output increased sharply; owing to low iron content in the ore, however, the iron ore supply by domestic producers decreased to about 50% of the demand in 2005 from 75% in the 1990s. The Government planned to close down 100 Mt/yr of steel output capacity in the next 5 years, but major iron and steel producers planned to expand their outputs, and several greenfield integrated plants were under construction. China's steel output capacity was projected to reach more than 500 Mt/yr by 2010. The percentage rate of iron ore supply from domestic producers was expected to decline, and iron ore imports to China were expected to increase in the future (Tse, 2006).

Steel producers, which produced high-value-added steel products, such as automotive sheets, preferred imported ore. With the Government's encouragement and approval, China's iron and steel producers looked overseas to secure iron ore supplies. China's state-owned iron and steel producers, such as Angang, the Baoshan Iron and Steel Group (Baogang), Shagang, Shougang, and Wuhan Iron and Steel Group (Wugang), signed joint-development agreements with companies in Australia and Brazil. Domestic iron and steel producers invested in iron ore projects in Kyrgyzstan, Mongolia, and Russia. Xinjiang

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Nonferrous Metals Exploration Co. and its alliances explored for iron ore in Kyrgyzstan in 2004 and planned to invest $125 million to develop the iron ore deposit. Baotou Iron and Steel Group Co. signed a 20-year iron ore contract with Mongolia's Tumurtei Iron Ore Co. Ltd., which was a joint venture between three Chinese companies and a Mongolian company. Baotou also planned to invest in a Chinese iron ore company that planned to develop an iron ore deposit in Mongolia. Mengdong Energy Co. Ltd. received approval from NDRC to develop the Berezove Iron Mine in Russia. Shandong Luneng Group obtained a 25-year mining right at Byelizovski Iron Mine, which is located about 20 km from the China-Russia border in Russia (China Metals, 2006d).

China was one of the fastest growing markets for stainless steel in the world. China consumed about 6 Mt of stainless steel in 2005. In 2005, China imported 3.14 Mt of stainless steel products, mainly from Japan, the Republic of Korea, and Taiwan and exported 467,198 t. China intended to reduce its dependence on imports and expanded stainless steel production during the past several years. In 2005, China produced more than 4.6 Mt of crude stainless steel, which was expected to increase to 5.5 Mt in 2006; China was expected to consume about 6.6 Mt in 2006. State-owned and privately owned steel producers expanded their output capacities during the past 2 years. China's leading stainless steel producer, Taiyuan Iron and Steel Group Co. (Taigang), planned to expand its stainless steel output capacity to 3 Mt by 2006. Baogang completed its hot-rolled stainless steel output capacity to 1.5 Mt/yr in 2005, and Jiuquan Iron and Steel Group Co. Ltd.'s 600,000-t/yr stainless steel mill was scheduled to be put into operation in 2006. Zhangjiagang Pohang Iron and Steel Co.'s 600,000-t/yr stainless steel mill was expected to be put into operation in 2006, and Alliance Steel Co. (a subsidiary of Yieh United Iron and Steel Co. of Taiwan) completed its 300,000-t/yr stainless steel mill in 2005. Southwest Stainless Steel Co., which was a privately owned enterprise, completed the installation of its 60-t electric arc furnace, which would have an output capacity of 300,000 t/yr of stainless steel in 2005. Shandong Quanxin Stainless Steel Co. planned to put its 180,000-t/yr mill into operation in 2005 and planned to expand its output capacity to 400,000 t/yr in 2006. The total stainless steel output capacity of privately owned steel enterprises would be about 5 Mt/yr by 2007. In total, China was expected to have a stainless steel output capacity of more than 10 Mt/yr by 2010. Domestic analysts estimated that China's stainless steel consumption could reach 10 Mt by 2010 (Li, 2005).

During the past decade, the Government urged iron and steel enterprises to merge or to take over other iron and steel producers in the same region. The process was slow and faced resistance from steel enterprises. Because of environmental concerns and the 2008 Beijing Olympic Games, the Central Government and the Beijing City government urged Shougang to reduce its output capacity in Shijingshan, Beijing, and to move production facilities to Hebei Province. Shougang planned to build a 15-Mt/yr greenfield iron and steel facility in Caofeidian, Hebei Province. Tangshan Iron and Steel Group Co. (Tanggang) was the leading iron and steel enterprise in Hebei Province. With the encouragement of and approval by the Government, Shougang and Tanggang (51% and 49% equity, respectively) formed a joint-venture company, Shougang Beijing-Tangshan Iron and Steel Group Co. Ltd., in Hebei Province. The joint-venture company planned to have a 10-Mt/yr first-phase integrated iron and steel plant in operation in Caofeidian by 2007 (China Metals, 2005e).

More than 200 steel producers were located in Hebei Province, which was the leading steel producing province in China; most of them were small producers and privately owned companies. The Provincial government urged these steel producers to merge into larger groups and to upgrade their equipment. With Provincial government approval, the Hebei Provincial State Asset Supervision and Management Commission drew up a consolidation plan to merge state-owned iron and steel enterprises in Hebei Province. The northern group, which included Chengde Steel Co., Tanggang, and Xuanhua Steel Co. formed New Tanggang Group. The southern group included Handan Steel Group, Shijiazhuang Steel Co., and Xingtai Steel Co. Handan was not interested in the Government consolidation plan because Handan had established strategic cooperation agreements with Delong Steel Co. and Wengeng Steel Co. in the southern area. Baogang held more than 5% of Handan's total shares on the Shanghai Exchange Market. Handan also discussed the formation of alliances with multinational steel producers (China Metallurgical News, 2005; Interfax Information Services, 2005).

In Liaoning Province, Angang and Benxi Iron and Steel Group (Bengang) announced that the two leading integrated steel producers in the Province had merged to form a new company, Anben (Anshan-Benxi) Iron and Steel Group, in August 2005. The new company planned to increase its output capacity to 30 Mt/yr by 2010. In the 1990s, Angang and Bengang were state-owned companies; Bengang, however, was assigned to be managed by the local government and paid revenue tax to the Benxi City government when the decentralization of state-owned enterprises was completed in the late 1990s. Angang remained under the Central Government and its tax revenue was paid directly to the Central Government. The merger initially will combine the two companies' raw material purchases, technology development, and marketing strategies. Angang has a wider variety of products than Bengang. Bengang has concentrated on hot-rolled and cold-rolled products. It could take years for the merger to operate as one company. Angang planned to build a 10-Mt/yr greenfield steel facility in Bayuquan District, Yingkou City, Liaoning Province. Construction of a new plant in Yingkou will reduce transportation costs. The first-phase 5 Mt/yr of steel output capacity was scheduled to be put into operation in October 2006. Angang also planned to add 5 Mt/yr of steel output capacity to its production facility in Anshan (China Metals, 2005a).

In Jilin Province, Jianlong Iron and Steel Group, Jilin Ferroalloy Co., and Tonghua Iron and Steel Group signed a merger agreement in November. The merged entity, which was named Tonghua Iron and Steel Group Co. Ltd., had a total steel output capacity of 5 Mt/yr and planned to expand the total iron and steel output capacity to 10 Mt/yr and ferroalloy output capacity to 3 Mt/yr in the next 3 years (China Metals, 2005d).

Two leading iron and steel producers in Shandong Province, Jinan Iron and Steel Group and Laiwu Iron and Steel Group Co.

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Ltd., submitted a merger plan to the Provincial government for approval. Both companies had output capacities of iron and steel of more than 10 Mt/yr. Facing a shortage of power and water supply and also the transportation bottlenecks, the consolidation was expected to reduce raw materials competition within the Province and to improve marketing strategies. Qingdao Iron and Steel Group was also considering participating in the merger. Baogang held 12% of Jinan's tradable shares and formed a joint venture with Companhia Vale do Rio Doce (CVRD) to build a 10-Mt/yr pelletizing plant in Rizhao City, Shandong Province. Initially, Arcelor Mittal Corp. intended to purchase 50% of the shares of Laiwu Group's listed company, Laiwu Steel Co. Ltd., because the Government would not allow foreign investors to hold major shares of a Chinese iron and steel company. Therefore, Arcelor settled for 37.51% of Laiwu Steel Co. Ltd.'s tradable share and Laiwu Group held 39.31%. The transaction required Government approval. Jinan and Laiwu Group planned to construct a 10-Mt/yr greenfield iron and steel plant and to expand total output capacity to more than 30 Mt/yr (China Metals, 2006e).

Wugang signed an agreement with the government of Guangxi Zhuang Autonomous Region to purchase 51% of Liuzhou Iron and Steel Plant. The share held by Guangxi Autonomous Region State Asset Supervisory and Management Commission was reduced to 49% of Liuzhou. Wugang and the government of Guangxi Zhuang Autonomous Region signed an agreement to build a 10-Mt/yr iron and steel plant, a 5-Mt/yr coke plant, and a 2.4-megawatt thermal powerplant in Fangchenggang; Fangchenggang is located on the coast and is an ideal location for importing iron ore and exporting steel products. A 200,000-deadweight-ton (dwt) iron ore berth was under construction at the Port of Fangchenggang. The Committee of the Economic and Trade Commission approved the feasibility study of the iron and steel plant, which was submitted to NRDC for final approval. Wugang also discussed a merger and restructuring with Chongqing Steel Group. Both Baogang and Panzhihua Iron and Steel Group Co. also showed interest in forming alliances with Chongqing (China Metals, 2005f).

The Guangdong Provincial government submitted a 10-Mt/yr steel project to the NDRC for approval. The steel plant would be located in Zhanjiang. The East Sea island of Zhanjiang had a 300,000-dwt ship dock and a 500,000-dwt oil tanker dock; a 200,000-dwt iron ore berth was under construction. Baogang and Shaoguan Iron and Steel Group signed an agreement to participate in the development of the project. The Zhanjiang project could be a strategic base for Baogang to expand its production and marketing base in southern China. Baogang also signed strategic alliances with Bayi Iron and Steel Group Co. in Xinjiang Uygur Autonomous Region, Ma'anshan Iron and Steel Group Co. in Anhui Province, and Taigang (Interfax Information Services, 2006d).

Lead and Zinc.—Bayannur Zijin Nonferrous Metal Co. Ltd. (BZNM) started construction of its 100,000-t/yr zinc smelter in Urad Houqi, Bayannur Meng, Nei Mongol Autonomous Region. BZNM was a joint venture of Jianxin Industry Group, Yate Investment Co. Ltd., and Zijin Mining Co. The smelter was scheduled to start operation in mid-2006, and the total investment was about $100 million. The company had secured zinc concentrates within the Nei Mongol Autonomous Region and planned to add another 100,000 t/yr of output capacity in the future (Interfax Information Services, 2006g).

Aerhada Mining Co. Ltd. started construction of its 100,000-t/yr zinc smelter in Dong Ujimqin Banner, Xilin Gol Meng, Nei Mongol Autonomous Region, in 2005 and was scheduled to put it into operation in 2006. Raw material would come from the Aerhada Polymetallic Mine, which was operated by Chifeng Bayanhanshan Mining Co. Ltd. The mine had a dressing plant with a 1,500-t/d output capacity of lead and zinc concentrates that was put into operation in 2005. The Dong Ujimqin Bannar had proven reserves of more than 500,000 t of lead and zinc and 600 t of silver. Lead and zinc resources in the area were estimated to be more than 1 Mt. Chifeng Bayanhanshan started to build a 60,000-t/yr lead smelter in Bairin Zuoqi, Chifeng City, and was scheduled to put it into operation in July 2007 (China Metal Bulletin, 2006b).

The construction of Bairendaba Silver Polymetallic Mine was completed and began trial production in September 2005. The mine is located in Hexighten Bannar, Chifeng City, Nei Mongol Autonomous Region. The mine, which was jointly developed by Chifeng Honghuagou Gold Mine Co. Ltd., Gansu Shengda Group Co. Ltd., and Nei Mongol Mining Development Co. Ltd., was designed to produce 2,000 t/d of ore. The mine had reserves of 1.05 Mt of zinc, 503,000 t of lead, 4,600 t of silver, and about 2 t of gold. The total investment was $18 million. The processing plant had the capability to produce 20,000 t/yr of zinc, 10,000 t/yr of lead, and 98 t/yr of silver (Lead, Zinc, and Tin Monthly, 2005).

Magnesium.—China was the leading producer of magnesium in the world. Magnesium metal output accounted for more than 60% of the world total. The country exported more than two-thirds of its output. In 2005, China's magnesium consumption increased to about 105,000 t. Exports of magnesium products decreased to 353,100 t in 2005 from 383,738 t in 2004, of which 183,573 t and 228,350 t, respectively, was metal. Since 2001, when several magnesium plants in Europe and North America were shut down, China's magnesium filled in the supply gap in these two areas. China exported about 40% of its magnesium products to European countries followed by Japan, the Republic of Korea, and Taiwan. During the past 5 years, China's magnesium producers expanded their output capacities. There were 116 magnesium producers, of which 109 were privately owned and Sino-foreign joint ventures. The total output capacity of alloy, granule, and metal was about 700,000 t in 2005. During the past 2 years, the Government urged the magnesium producers to produce high-value-added products, such as alloy plates and tubes. To control further output capacity expansion, the Government restricted the construction of less-than-3,000-t/yr-output-capacity magnesium plants and reduced the export VAT rebate to 5% for metal. Owing to environmental problems, the Henan Provincial government shut down several small magnesium plants that did not meet environmental standards. The Provinces of Henan, Ningxia, and Shanxi accounted for 90% of the country's total magnesium output (China Metal Bulletin, 2006a).

Manganese.—China is the leading producer of ferroalloys in the world. During the past several years, production of

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ferroalloys grew by double digits. At yearend 2005, there were 1,570 ferroalloy producers with a total output capacity of 22.13 Mt, which was more than three-fold that of 2000. In addition, about 1.61 Mt of ferroalloy output capacity was under construction, and an additional 1.23 Mt of output capacity was planned. Ferromanganese and ferrosiliconmanganese alloy accounted for about 50% of the total ferroalloy output. In 2005, China consumed about 9.3 Mt and exported 1.74 Mt of ferroalloys. Many ferroalloy producers operated at less than 50% of their output capacity. China was one of the leading manganese producers in the world. Because of increased demand for manganese by the ferroalloy sector, however, the country imported manganese ore from overseas. During the past 2 years, China imported more than 4 Mt of manganese ore from countries in Africa, and from Australia and India. High-carbon ferromanganese, which contained 65% manganese, accounted for 75% of the total ferromanganese output in 2004 and was one of China's major ferroalloy export products. In 2005, the Government prohibited tolling trading for ferromanganese and ferrosiliconmanganese. Production costs were expected to increase and forced small ferromanganese producers to shut down their operations. According to NDRC development guidelines, the Government was to tighten control of investment in the ferroalloy sector and planned to shut down small furnaces (less than 300 cubic meters) that were used mainly for ferromanganese production and less-than-5,000-kilovolt-ampere electric arc furnaces. The Government also planned to shut down those ferroalloy plants that did not meet the national environmental standards. About 69% of the ferroalloy plants in existence did not meet the standards. The country's ferroalloy output capacity was expected to be reduced to 17 Mt by 2010 (China Metals, 2006c; Yang, 2005).

China was the leading producer of unwrought manganese in the world. During the past 15 years, unwrought manganese production increased to about 57,000 t in 2005 from 14,000 t in 1991. During the past 10 years, China exported more than 50% of its total output. China's manganese resources, which are located in the Provinces of Guangxi, Guizhou, and Hunan, accounted for 60% of the total manganese resources in the country. About 80% of manganese ore was produced by locally owned and privately owned mines, and the Government had difficulty accounting for the actual output. China's electrolytic manganese was produced mainly from the reduction of low-grade manganese carbonate ore, which contained from 18% to 20% manganese. Most manganese plants had output capacities of less than 10,000 t/yr. Owing to environmental damage and high energy consumption, the Government issued regulations to control the expansion of the electrolytic manganese sector. According to the guidelines, any new electrolytic manganese plant must have a total output capacity of more than 30,000 t/yr and each production line must have an output capacity of more than 10,000 t/yr. Existing plants with production lines of less than 3,000 t/yr of output capacity were ordered to shut down. The reduction tank in plants must be larger than 250 cubic meters, and a high-pressure diaphragm filter must be installed in the plants. The tonnage energy consumption was expected to be less than 8,600 kilowatt hours for grades A and B manganese ingot (China Metals, 2006b).

Tin.—China was the leading tin producing country in the world. Because of strong domestic and international demand, tin prices increased to $8,650 per metric ton in March 2005 and declined to less than $7,000 per metric ton at yearend. Because domestic supply of concentrates increased, China's tin metal production increased in 2005 compared with that of 2004. Imports of tin concentrates decreased to 7,485 t in 2005 from 8,912 t in 2004, and those of refined tin increased to 19,011 t in 2005 from 9,612 t in 2004. Because the Government reduced the export VAT rebate on tin, China's refined tin exports decreased to 22,928 t in 2005 from 32,032 t in 2004, and tin alloy exports decreased to 4,085 t in 2005 from 6,993 t in 2004. Owing to the increase in domestic demand for refined tin, the volume of tin exports from China could drop to less than 20,000 t in 2006 from more than 60,000 t in the 1990s. Because of the shortage of tin concentrates, China imported about 13,000 t of crude tin from Indonesia in 2005. Indonesia also exported crude tin to Malaysia, Singapore, and Thailand for refining and became the leading crude tin supplying country in the world. Hunan Province replaced Guangxi Zhuang Autonomous Region as China's major tin ore producing province behind Yunnan Province. China's tin consumption increased to 94,000 t, of which tin solder accounted for 50%. The supply of tin concentrates from domestic mines was expected to remain tight, and imports of tin concentrates were expected to increase in 2006. China could become a net tin importer in the near future (Lead, Zinc, and Tin Monthly, 2006a).

Industrial Minerals

Cement.—China was the leading cement-producing country in the world and accounted for nearly 50% of the world's total. Even with the Government's restricted investment policy for the cement sector, cement output continued to increase. During the past 5 years, China's production increased by an average of about 12% per year. China's cement consumption was driven by infrastructure investment and residential and nonresidential construction. The Government's continued emphasis on large infrastructure projects included bridges, dams, roads, and utilities. Each year, cement producers produce more than 200 Mt of industrial wastes, which accounts for 50% of total industrial wastes. More than 6,000 cement producers produced on an average of about 200,000 t/yr each. In 2005, the State Council issued a circular urging cement producers to merge to form large groups. The Government set the target of reducing the number of cement producers to 3,500 and to increasing their average output capacity to 400,000 t/yr by 2010. Of the total cement producers, the top 10 will have an output capacity of more than 30 Mt/yr each. China was expected to produce 1.25 billion metric tons of cement, and the top 50 producers would account for 50% of the output in 2010. The Government encouraged cement producers to produce more medium- and high-grade cement to meet the demand. The Government stepped up its efforts to shut down plants that used obsolete technology and encouraged cement producers to use dry rotary kilns. Output of cement from dry rotary kilns was projected to increase to 70% of the total in 2010 from 40% in 2005. Per tonnage power consumption was expected to be reduced by 25% (State

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Council, 2005; National Development and Reform Commission, 2006c).

Phosphate Rock.—China was one of the leading phosphate rock producing, consuming, and exporting countries in the world. Owing to domestic demand, phosphate rock exports decreased to 2.11 Mt in 2005, which was 32.3% lower than those of 2004. Exports of such phosphorus products as sodium triphosphate and phosphoric acid, however, increased. Nearly 90% of phosphate rock mined in China was used to produce chemical fertilizers. The Provinces of Guizhou, Hubei, Yunnan, and Sichuan, in descending order of output, accounted for 98% of the country's total output. The average ore grade of phosphate rock in China contains 16.95% P_2O_5; phosphate rock that contains more than 30% P_2O_5 accounts for 8.1% of the country's total reserves, which are located in the Provinces of Guizhou and Yunnan. China's phosphate fertilizer output was large, but the average producer output capacity was small. The 1,043 phosphate fertilizer producers had a total combined output capacity of 12.5 Mt/yr at yearend 2004. More than 60% of phosphate fertilizer producers have output capacities of less than 5,000 t/yr. According to the MLR report, the domestic supply of phosphate rock will not meet the demand by 2010. In 2005, the country produced 11.25 Mt (in P_2O_5 content) of phosphate fertilizer. China was projected to produce 12 Mt (in P_2O_5 content) of phosphate fertilizer and to consume about 46.5 Mt of phosphate rock in 2010. At that time, the country will be required to import 8 Mt of phosphate rock to meet its needs (China Chemical News, 2005a).

The Government planned to reform the fertilizer sector in China. Currently, the Government determines the prices of chemical fertilizer based on production costs and supply and demand in the domestic market. NDRC assigned prices to ammonium nitrate and urea, which were produced by state-owned producers, and to imported fertilizer. Regional governments determined prices of other fertilizers. Even though the quality was the same, the price of domestically produced phosphate fertilizer was from $25 to $50 per metric ton lower than that of imports. Owing to the separate production and marketing system in China, fertilizer producers had no incentive to reduce production costs or to introduce technological development. The Government set up a committee to study how to control the supply and demand in the domestic market without controlling the selling prices of fertilizer. Transportation bottlenecks were another problem that the Government considered. More than 16 Mt of phosphate rock was stockpiled in Guizhou Province awaiting transport to fertilizer plants in other provinces (China Chemical Reporter, 2005).

Daqing Petrochemical Co. Ltd., which was a subsidiary of China National Petroleum Corp., and Sichuan Gaoyu Group planned to build a 300,000-t/yr monoammonium phosphate (MAP) plant in Yang'an Town, Chengdu City, Sichuan Province. In addition, the joint venture also constructed a 60,000-t/yr ammonia unit and a 300,000-t/yr sulfuric acid unit at the plant site. Heat generated from the sulfuric acid unit will be used in a 3-megawatt power generating unit. Pyrite cinders from the sulfuric acid production and phosphogypsum from MAP production will be used for the cement production. Initial investment was estimated to be $66 million, and construction would take 3 years to complete (China Chemical Reporter, 2006a).

Rare Earths.—China was the leading rare-earth producer and exporter in the world. The country's rare-earth exports accounted for more than 70% of the world trade of rare earths. In 2005, China produced about 119,000 t of ore [in rare-earth oxide (REO) content] and 104,000 t of rare-earth products. China consumed about 52,000 t of rare earths and exported 74,276 t (or the equivalent of 55,613 t REO content) of rare-earth products, including permanent magnet products in 2005. In May 2005, the Government cancelled the export VAT rebate on rare-earth products and added rare-earth concentrates to the prohibited-for-processing-trade list. The State Council was the sole approving office for rare-earth mining and smelting projects (National Development and Reform Commission, 2005b).

China's rare-earth production exceeded the world consumption, which was about 100,000 t in 2005. There were about 100 rare-earth producers in China with a total output capacity of 200,000 t/yr of rare-earth concentrates and 160,000 t/yr of rare-earth-products processing capacity. Even though rare earths was a highly controlled sector in China, the Government had difficulty controlling the volume of output. The Government issued a mining output quota for each rare-earth producing province; the total output of rare earths, however, exceeded the Government target at yearend. The MLR assigned a rare-earth output quota of 86,620 t, including 8,320 t of heavy rare earths and 78,200 t of light rare earths in 2006, which was much lower than those of previous years. Nei Mongol Autonomous Region was assigned the production quota of 46,000 t. Sichuan Province, which produced light rare earths, was allocated 31,000 t, and Jiangxi Province, where medium and heavy rare earths were based, was allocated 7,000 t. The rest of the rare-earth-producing provinces, such as Fujian, Guangdong, and Hunan, were allocated proportionally according to their output capacities (China Nonferrous Metals Monthly, 2006c).

Although China's total output capacity was huge, the average capacity for each producer was small. As a result, the profitability was low and the product quality was inconsistent between different shipments. During the past 15 years, the Government made many attempts to consolidate the rare-earth producers into larger entities. In 2002, the State Council approved the restructuring of the domestic rare-earth sector and the establishment of two regional groups—China Northern Rare Earth Group Co. and China Southern Rare Earth Group Co. Owing to the reluctance of local governments and rare-earth producers, the establishment of two regional groups appeared unsuccessful. Once again, the Government urged rare-earth producers to merge into several large groups and to eliminate duplicate projects.

China's largest rare-earth resource was at the Baiyunobo, Nei Mongol Autonomous Region, which accounted for 80% of the country's reserves. The rare-earth concentrate, which is known as Baotou rare-earth concentrate, is a byproduct of producing iron ore. The eastern part of the ore body contained about 5% of rare earths, and the western part of the ore body contained a very low percentage of rare earths. After nearly 4 decades of exploitation, about 250 Mt of ore was mined out and produced 12.5 Mt of rare-earth slag, of which 9.30 Mt was unseparated

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and stored in a big pond awaiting processing into concentrates or fully separated into rare-earth products. The eastern part of the ore body also contained about 0.032% of thorium, which was not yet separated. During the past decade, China was the major rare-earth trading country in the world. The beginning of exploitation of monazite in the Mount Weld in Western Australia will post a challenging competition for China's rare-earth producers in the future (Industrial Minerals, 2006a, b).

Salt.—China was one of the leading salt producing countries in the world. China's salt production was from marine salt and inland salt. Marine salt accounted for 70% of the total output; the major marine salt fields were located in the Bohai region. Inland salt was from lakes and wells mainly from central and northwest China and the Nei Mongol Autonomous Region, which accounted for 30% of the total. China had about 800 registered salt producers, and the average output capacity was 50,000 t/yr. Salt producers continued to use 1980s technology for salt recovery, and such valuable elements as iodine and potassium (which China was required to import) were not recovered during the process. Domestic analysts estimated that about 5 Mt of magnesium, 500,000 t of potassium, and 50,000 t of iodine were discarded each year. About 90% of China's salt was used by the soda ash and caustic soda sectors. The development of the salt sector was hampered by the existence of monopolies and high taxation. During the past 5 years, salt production increased by an average of about 8% per year; soda ash and caustic soda production, however, increased by more than 10% per year. In 2004, China imported more than 2 Mt of salt to meet its needs. At yearend 2005, China had a total salt output capacity of 55 Mt/yr, of which marine salt accounted for 57.3%; well salt, 33.2%; and lake salt, 9.5%. The total output capacity of salt was expected to increase to 65 Mt by 2010 (China Chemical News, 2005b).

In 2005, the Government issued guidelines on how to reform the salt sector in China. The Government planned to shut down small marine salt fields in southern China and merge salt producers together by region. Marine salt producers will be expected to have output capacities of more than 300,000 t/yr, and lake and well salt producers will be required to have output capacities of more than 100,000 t/yr. The Government assigned China Salt Corp. to develop a plan for how to implement the guidelines (National Development and Reform Commission, 2005c).

Strontium.—China's strontium sector developed quite rapidly during the past decade, and the country became one of the leading producers of strontium carbonate in the world. Strontium carbonate was produced from celestite by either the carbon reduction method or the decomposition method. China's celestite resources are located in the Provinces of Hubei, Jiangsu, Qinghai, Sichuan, and Yunnan, and in Chongqing City. Compared with such countries as Mexico and Spain, the strontium sulfate content in Chinese celestite was lower. Ore from the Dafengshan Celestite Mine in Qinghai Province, which is the largest celestite mine in China, contains less than 40% strontium sulfate. Some of China's celestite deposits contain strontium sulfate content of up to 90%, but they are small in terms of quantity. Most of the salable celestite ore contained less than 70% strontium sulfate. The Government urged celestite producers to mine low- and high-grade ore together and to increase ore grade through the dressing process. Numerous strontium carbonate producers in China have a total combined output capacity of 350,000 t/yr, but the combined production of celestite was about 500,000 t/yr. The gap between supply and demand was met by imports. The leading strontium carbonate producer was Chongqing Tongliang Redbutterfly Strontium Co., which was a Sino-Japanese joint venture located in Chongqing City. China's television cathode ray tube (CRT) glass sector was the leading consumer of strontium carbonate and accounted for 60% of the total domestic consumption (China was the leading CRT producer in the world). The permanent ceramic magnet sector was the second ranked consumer followed by the chemical and metallurgy sectors (China Chemical News, 2005c; Zhang and others, 2005).

Mineral Fuels

Coal.—During the past three decades, China has undergone significant economic reform and has one of the world's fastest growing economies. Coal consumption has increased to meet the demand for industrial production and power generation. From 1996 through 2005, China's coal production increased to more than 2 Gt. Owing to an increase in demand and transport capacity constraints, domestic coal prices and coal imports to southern China increased during the past 3 years. As a result of an insufficient supply of coal, electricity from coal-fired powerplants was disrupted in many parts of the country. Powerplants accounted for 50% of the country's coal consumption. To secure an adequate supply of coal, a number of coal and power generation companies formed alliances by investing in each other's publicly listed shares in domestic and international stock exchange markets. The Government remained in control of substantial shares in the coal and power sectors (Interfax Information Services, 2006c).

China was not only a large coal producer and consumer but also one of the world's leading coal exporters. Coal exports increased to 94 Mt in 2003 from 55 Mt in 2000, mainly to Japan, the Republic of Korea, and Taiwan. Owing to transport constraints and increased domestic demand, however, the Government reduced its coal export quota to 80 Mt in 2004, 2005, and 2006. The Government allocated the majority of coal export licenses to four state-owned companies—China Coal Group Corp., Minmetals Group, Shanxi Import and Export Group Corp., and Shenhua Group Corp. Coal imports to China accounted for approximately 1% of China's coal consumption. Australia, Indonesia, and Vietnam were the leading coal suppliers to China (Interfax Information Services, 2006a).

During the past 5 years, fixed asset investment in the coal sector totaled $31.1 billion and the total output capacity of regulated coal mines increased to 2.26 Gt at yearend 2005. More than 600 Mt/yr of coal mine output capacity was under construction. By 2010, China will have a total coal output capacity of about 2.9 Gt; the Government's coal production target for 2010 is 2.45 Gt. NDRC issued coal development guidelines to reform the coal sector in China. The Government established 13 large-scale coal regions, which included 45 coal bases that have total coal reserves of more than 700 Gt.

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The purpose of establishing of these regions was to match coal resources with the development of the chemical, metallurgical, and power sectors. The Provinces of Shaanxi and Shanxi and the Nei Mongol Autonomous Region accounted for 64% of China's coal resources. New shafts at coalmines in these Provinces are required to have an output capacity of more than 300,000 t/yr. The minimum output per shaft at coal mines in the country's north, northeast, and northwest regions and in Henan Province is 150,000 t/yr; in other parts of China, it is 90,000 t/yr. The increased output capacity of each shaft in coal mines was intended to encourage the construction of larger and more-efficient coal mines. The Government planned to establish between five and seven coal enterprises, which would have output capacities of more than 100 Mt/yr each. Large- and medium-sized coal producers would account for 75% of the total output capacity, and mechanical mining would increase to 95%. Coal mines must meet environmental and safety regulations. During the first 3 years of new mine operation, the Government will not approve any expansion plans. Any developing coal mine that does not meet the above guidelines will be shut down. China had more than 28,000 coal producers; many coal mine shafts had output capacities of less than 30,000 t/yr, and about 3,500 coal mines had output capacities of less than 100,000 t/yr. Many mine accidents happened in these small-sized coal mines each year. The Government planned to shut down 8,000 small-sized coal mines during the next 2 years (State Council, 2005; Coal News, 2006; National Development and Reform Commission, 2006b).

Natural Gas and Petroleum.—Owing to the sustained expansion of the economy, China's dependence on oil imports increased to 44% of the country's total demand in 2005. The Government had developed plans to secure the oil supply in the future. NDRC estimated that the growth of proven oil reserves and production capacity of large oilfields in China would be limited and that China would produce 180 to 200 Mt/yr during the next 5 years. Oil production in the eastern region gradually decreased to 59% in 2005 from 72.2% in 2000, and the output of oil from the western region and offshore gradually increased to 24.6% and 16.4%, respectively, in 2005 from 16.6% and 11.2%, respectively, in 2000. The Government planned a second west-east pipeline to transport oil and gas from the production center in Xinjiang Uygur Autonomous Region to consumption centers in the coastal areas in the next 5 years (China Chemical Reporter, 2006b; China Economic News, 2006a).

NDRC estimated that oil consumption in China would reach 500 Mt by 2020, of which 300 Mt would be imported. The Government encouraged China's oil and gas enterprises to intensify their efforts in exploration and development of oil resources to control the volume of tradable oil reserves in other countries. More than 80% of oil was used by the chemical sector; this sector accounted for about 20% of industrial output and that percentage was expected to increase in the future. To sustain development of the chemical and chemical fiber sectors, the Government planned to build four oil import projects—China-Kazakhstan, China-Russia, the Strait of Malacca, and Sino-Burma offshore oil transport to increase oil delivery to China (China Economic News, 2006c).

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TABLE 1

CHINA: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Commodity[3]		2001	2002	2003	2004	2005
METALS						
Aluminum:						
Bauxite, gross weight	thousand metric tons	9,800	11,000	13,000	15,000	18,000
Alumina	do.	4,650	5,450	6,110	6,990	8,610
Metal, refined, primary and secondary	do.	3,570	4,510	5,970	6,900	7,800
Antimony:						
Mine, Sb content		140,000	100,000	100,000	125,000 r	120,000
Metal		148,000	124,000	90,000	115,000 r	124,000
Bismuth:						
Mine output, Bi content		2,000	2,000	2,500 r	3,000 r	3,000
Metal		2,000	3,500 r	5,000 r	11,700 r	8,500
Cadmium, smelter		2,510	2,440	2,700	4,530 r	5,000
Chromite, gross weight	thousand metric tons	182	180	200	200	200
Cobalt:						
Mine output, Co content		150	1,000	700	1,260 r	1,300
Metal		680	980	990	5,600 r	6,000
Copper:						
Mine output, Cu content		587,000	568,000	610,000	742,000	762,000
Metal:						
Smelter, primary	thousand metric tons	1,150	1,180	1,380	1,500 r	1,700
Refined:						
Primary	do.	1,220	1,300	1,420	1,580 r	1,850
Secondary	do.	300	350	430	620 r	750
Total	do.	1,520	1,650	1,850	2,200	2,600
Gold, mine output, Au content		185	192	205	215	225
Indium		190	160	180	200	300
Iron and steel:						
Iron ore, gross weight	thousand metric tons	220,000	231,000	261,000	320,000 r	420,000
Pig iron	do.	155,540 4	170,850 4	213,670 4	251,850 4	343,750 4
Ferroalloys	do.	4,500	4,840	6,340	8,670	10,700
Steel, crude	do.	151,630 4	182,370 4	222,340 4	272,800 4	353,240 4
Steel, rolled	do.	160,680 4	192,520 4	241,080 4	297,230 4	377,710 4
Lead:						
Mine output, Pb content		676,000	641,000	955,000	998,000 r	1,000,000
Metal:						
Smelter, primary		840,000	916,000	1,280,000 r	1,460,000 r	1,700,000
Refined						
Primary		984,000	1,100,000	1,290,000	1,510,000 r	1,870,000
Secondary		211,000	230,000	290,000	430,000 r	520,000
Total		1,200,000	1,330,000	1,580,000	1,940,000 r	2,390,000
Magnesium metal and alloy		200,000	230,000	342,000	442,000 r	470,000
Manganese:						
Ore, Mn content	thousand metric tons	860	900	920	1,100 r	1,200
Metal		150,000	190,000	320,000	492,000 r	566,000
Mercury, mine output, Hg content		190	495	610	1,140 r	1,100
Molybdenum, mine output, Mo content		28,200	29,300	31,000	38,500 r	40,000
Nickel:						
Mine output, Ni content		51,500	53,700	61,000	75,600 r	77,000
Matte		59,000	59,200	69,300	74,000 r	75,000
Smelter		49,500	52,400	64,700	75,800 r	95,000
Silicon, metal		500,000	580,000	680,000	750,000 r	840,000
Silver, mine output, Ag content		1,910	2,200	2,400	2,450	2,500
Tin:						
Mine output, Sn content		95,000	62,000	102,000	118,000 r	120,000
Metal		105,000	82,000	98,000	115,000	125,000

See footnotes at end of table.

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TABLE 1--Continued
CHINA: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Commodity[3]		2001	2002	2003	2004	2005
METALS--Continued						
Titanium:						
Ilmenite, TiO_2 equivalent		150,000	375,000	400,000	420,000	450,000
Sponge		2,470	3,650	4,120	4,810 r	9,280
Tungsten, mine output, W content		42,100	55,100	55,500	60,000 r	61,000
Vanadium, in vanadiferrous slag product		30,000	33,000	35,000	40,000	42,500
Zinc:						
Mine output, Zn content	thousand metric tons	1,700	1,550	2,030	2,390 r	2,450
Refined, primary and secondary	do.	2,040	2,100	2,320	2,720 r	2,800
INDUSTRIAL MINERALS						
Asbestos		310,000	562,000	500,000	400,000 r	350,000
Barite	thousand metric tons	3,600	3,100	3,600	3,900	4,200
Boron, mine, B_2O_3 equivalent		150,000	145,000	130,000	135,000	140,000
Bromine		40,000	42,000	42,000	4,300	4,350
Cement, hydraulic	thousand metric tons	661,040 4	725,000 4	862,080 4	970,000 4	1,068,850 4
Diatomite		350,000	370,000	380,000	390,000	410,000
Dolomite	thousand metric tons	6,700	7,000	7,300	7,500	7,800
Fluorspar	do.	2,450	2,450	2,650	2,700	2,700
Graphite		450,000	629,000	710,000	700,000	720,000
Gypsum	thousand metric tons	6,800	6,850	6,850	7,000	7,300
Kaolin	do.	3,500	3,600	3,700	3,750	3,800
Lithium minerals, all types		16,000	16,000	17,000	18,000	19,000
Magnesite	thousand metric tons	3,580	4,560	4,600	4,650	4,700
Nitrogen, N content of ammonia	do.	28,200 4	30,300 4	31,500 4	34,770 4	37,850 4
Phosphate rock, P_2O_5 equivalent	do.	6,300	6,900	7,550	7,650	9,130
Potash, marketable, potassium oxide equivalent	do.	385	450	500	550	600
Rare earths, rare-earth oxide equivalent		81,000	88,000	92,000	98,000	119,000
Salt	thousand metric tons	34,105 4	36,024 4	34,377 4	37,100 4	46,610 4
Sodium compounds:						
Mirabilite	do.	4,200	5,000	5,800	6,300	6,300
Soda ash, natural and synthetic	do.	9,144 4	10,330 4	11,336 4	13,024 4	14,211 4
Strontium carbonate		50,000	100,000	130,000	150,000	180,000
Sulfur:						
Native	do.	420 r	540 r	700 r	820 r	900
Content of pyrite	do.	3,090	3,240	3,400	3,730	4,010
Byproduct, all sources	do.	2,000	2,200	2,400	2,600	2,800
Total	do.	5,510 r	5,980 r	6,500 r	7,150 r	7,710
Talc and related materials	do.	3,500	2,500	3,000	3,000	3,050
MINERAL FUELS AND RELATED MATERIALS						
Coal:						
Anthracite	do.	190,000	250,000	218,000	220,000	245,000
Bituminous	do.	965,000	1,110,000	1,470,000	1,690,000	1,850,000
Lignite	do.	47,800	53,000	52,000	50,000	55,000
Total	do.	1,200,000	1,410,000	1,740,000	1,960,000	2,150,000
Coke, all types	do.	131,310 4	142,800 4	138,800 4	177,480 4	232,820 4
Gas, natural:						
Gross	billion cubic meters	30	33	35	41	50
Marketed	do.	24	26	28	34	42
Petroleum:						
Crude, including crude from oil shale	million 42-gallon barrels	1,210	1,240	1,260	1,300	1,350
Refinery products	do.	1,460	1,530	1,600	1,650	1,700

rRevised.

[1]Estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]Table includes data available through September 30, 2006.

[3]China also produces diamond, gallium, germanium, platinum-group metals, stone, and uranium, but available information is inadequate to make estimates of output.

[4]Reported by China's State Statistical Bureau.

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TABLE 2
CHINA: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies[1]	Location of main facilities	Annual capacity[e]
Aluminum:				
Alumina		Pingguo Aluminum Co. (Aluminum Corporation of China)	Guangxi, Pingguo	1,200
Do.		Guizhou Aluminum Plant (Aluminum Corporation of China)	Guizhou, Guiyang	1,200
Do.		Coalmine Aluminum (Sanmenxia) Co. Ltd.	Henan, Sanmenxia	400
Do.		East Hope (Sanmenxia) Aluminum Co. Ltd.	do.	400
Do.		Zhengzhou Aluminum Plant (Aluminum Corporation of China)	Henan, Zhengzhou	2,300
Do.		Zhongzhou Aluminum Plant (Aluminum Corporation of China)	Hunan, Zhongzhou	1,500
Do.		Bingzhou Weiqiao Aluminum Co.	Shandong, Zouping	1,000
Do.		Shandong Huayu Alumina Co. Ltd. (Shandong Chiping Xinfa Aluminum and Electricity Group)	Shandong, Chiping	800
Do.		Shandong Aluminum Plant (Aluminum Corporation of China)	Shandong, Zibo	1,500
Do.		Shanxi Aluminum Plant (Aluminum Corporation of China)	Shanxi, Hejin	2,200
Do.		Shanxi Luneng Jinbei Aluminum Co. Ltd.	Shanxi, Yuanping	1,000
Metal		Baiyin Aluminum Plant	Gansu, Baiyin	150
Do.		East Hope Aluminum Plant	Gansu, Baotou	250
Do.		Lanzhou Aluminum Plant	Gansu, Lanzhou	210
Do.		Liancheng Aluminum Plant	do.	235
Do.		Pingguo Aluminum Co. (Aluminum Corporation of China)	Guangxi, Pingguo	380
Do.		Guizhou Aluminum Plant (Aluminum Corporation of China)	Guizhou, Guiyang	400
Do.		Henan Zong Industry Co. Ltd.	Henan, Gongyi	180
Do.		Jiaozuo Wanfang Aluminum Co. Ltd.	Henan, Jiaozuo	300
Do.		Henan Wanji Aluminum Co. Ltd.	Henan, Luoyang	180
Do.		Henan Huanghe Mianchi Aluminum Plant	Henan, Mianchi	115
Do.		Sanmenxia Tianyuan Aluminum Co. Ltd.	Henan, Sanmenxia	110
Do.		Shangqiu Aluminum Smelter	Henan, Shangqiu	180
Do.		Yichuan Yugang Longquan Aluminum Co.	Henan, Yichuan	400
Do.		Henan Shenhuo Aluminum-Electricity Co. Ltd.	Henan, Yongcheng	200
Do.		Hanjiang Danjiangkou Aluminum Co. Ltd.	Hubei, Danjiangkou	73
Do.		Zhengzhou Aluminum Plant (Aluminum Corporation of China)	Hunan, Zhengzhou	60
Do.		Fushun Aluminum Plant	Liaoning, Fushun	190
Do.		Baotou Aluminum Plant	Nei Mongol, Baotou	250
Do.		Qingtongxia Aluminum Plant	Ningxia, Qingtongxia	400
Do.		Qinghai Aluminum Smelter (Aluminum Corporation of China)	Qinghai, Xining	360
Do.		Tongchuan Xingguang Aluminum Co. Ltd.	Shaanxi, Tongchuan	80
Do.		Shandong Chiping Xinfa Aluminum and Power Group	Shandong, Chiping	360
Do.		Taishan Aluminum-Power Co. Ltd.	Shandong, Fecheng	125
Do.		Shandong Nanshan Industry Co. Ltd.	Shandong, Longkou	160
Do.		Shandong Aluminum Plant (Aluminum Corporation of China)	Shandong, Zibo	120
Do.		Bingzhou Weiqiao Aluminum Co.	Shandong, Zouping	100
Do.		Huaze Aluminum and Power Co. Ltd.	Shanxi, Hejin	280
Do.		Taiyuan Oriental Aluminum Co.	Shanxi, Taiyuan	75
Do.		Shanxi Guanlu Aluminum Co. Ltd.	Shanxi, Yuncheng	210
Do.		Yunnan Aluminum Plant	Yunnan, Kunming	400
Antimony		Huaxi (China Tin) Group Industrial Co.	Guangxi, Hechi	25
Do.		Xikuangshan Twinkling Star Co. Ltd.	Hunan, Lengshuijiang	37
Asbestos		China National Nonmetallic Industry Corp.	Nei Mongol, Baotou; Shanxi, Lai Yuan and Lu Liang	130
Barite		do.	Guizhou, Xiangshou	NA
Bismuth	metric tons	Guangzhou Smelter	Guangdong,Guangzhou	300
Do.	do.	Shizhuyuan Nonferrous Metals Co. Ltd.	Hunan, Shizhuyuan	1,000
Do.	do.	Zhuzhou Smelter (Zhuye Torch Metals Co. Ltd.)	Hunan, Zhuzhou	350
Do.	do.	Yunnan Copper Group Co. Ltd.	Nei Mongol, Chifeng	300
Cadmium		Zhuzhou Smelter (Zhuye Torch Metals Co. Ltd.)	Hunan, Zhuzhou	1

See footnotes at end of table.

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TABLE 2--Continued
CHINA: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies[1]	Location of main facilities	Annual capacity[e]
Coal		Hebei Provincial Government	Hebei	70,000
Do.		Heilongjiang Provincial Government	Heilongjiang	100,000
Do.		Henan Provincial Government	Henan	100,000
Do.		Liaoning Provincial Government	Liaoning	70,000
Do.		Nei Mongol Provincial Government	Nei Mongol	90,000
Do.		Shandong Provincial Government	Shandong	60,000
Do.		Shanxi Provincial Government	Shanxi	400,000
Do.		Sichuan Provincial Government	Sichuan	80,000
Do.		Shenhua Coal Corp.	Ningxia, Nei Mongol, and Shaanx	150,000
Cobalt	metric tons	Jinchuan Nonferrous Metals Corp.	Gansu, Jinchang	1,200
Copper, refined		Jinchang Smelter (Tongling Nonferrous Metals Co.)	Anhui, Tongling	170
Do.		Jinlong Smelter (Tongling Nonferrous Metals Co.)	do.	210
Do.		Wuhu Smelter (Hengxin Copper Industry Group Co.)	Anhui, Wuhu	60
Do.		Baiyin Nonferrous Metals Co.	Gansu, Baiyin	50
Do.		Jinchuan Nonferrous Metals Corp.	Gansu, Jinchuan	120
Do.		Luoyang Copper Processing Factory	Henan, Luoyang	50
Do.		Daye Nonferrous Metals Co.	Hubei, Daye	160
Do.		Zhangjiagang United Copper Co. (Tongling Nonferrous Metals Co.)	Jiangsu, Zhangjiagang	150
Do.		Guixi Smelter (Jiangxi Copper Co. Ltd.)	Jiangxi, Guixi	400
Do.		Dongfang Copper Co. (Huludao Nonferrous Metals Group)	Liaoning, Huludao	100
Do.		Dongying Fangyuan Nonferrous Metals Co. Ltd.	Shandong, Dongying	100
Do.		Shandong Jinsheng Nonferrous Metals Corp.	Shandong, Linyi	100
Do.		Taiyuan Copper Industry Co.	Shanxi, Taiyuan	30
Do.		Zhongtiaoshan Nonferrous Metals Co.	Shanxi, Yuangu	85
Do.		Tianjin Copper Electrolysis Factory	Tianjin	25
Do.		Yunnan Smelter (Yunnan Copper Group Co. Ltd.)	Yunnan, Kunming	250
Gallium	metric tons	Shandong Aluminum Plant	Shandong, Zibo	10
Gas, natural	billion cubic meters	China National Petroleum Corp.	Sichuan	10
Germanium	metric tons	Yunnan Chihong Zinc and Germanium Co. Ltd.	Yunnan, Qujing	10
Gold, refined	do.	China National Gold Corp.	Henan, Lingbao	10
Do.	do.	Zhongyan Gold Smelter (Zhongjin Gold Co. Ltd.)	Henan, Sanmenxia	30
Do.	do.	Jiangxi Copper Co. Ltd.	Jiangxi, Guixi	12
Do.	do.	Laizhou Gold Co.	Shandong, Laizhou	15
Do.	do.	Zhaoyuan Gold Co.	Shandong, Zhaoyuan	15
Do.	do.	Great Wall Gold Silver Refinery	Sichuan, Chengdu	100
Graphite		Jixi Aoyu Graphite Co. Ltd.	Heilongjiang, Jixi and Luo	60
Do.		Nei Mongol Xinghe Jingxin Graphite Co. Ltd.	Nei Mongol, Xinghe	10
Indium	metric tons	Laibin Smelter [Liuzhou Huaxi (China Tin) Group Co.]	Guangxi, Laibin	60
Do.	do.	Liuzhou Zinc Products Co.	Guangxi, Liuzhou	20
Do.	do.	Zhuzhou Smelter	Hunan, Zhuzhou	60
Do.	do.	Huludao Nonferrous Metals Group Co.	Liaoning, Huludao	30
Iron and steel:				
Iron ore		Ma'anshan Iron and Steel Co.	Anhui, Maanshan	10,000
Do.		Shoudu (Capital) Mining Co.	Beijing	20,000
Do.		Meishan Metallurgical Co.	Shanghai	2,000
Do.		Jiuquan Iron and Steel Co.	Gansu, Jiayuguan	4,000
Do.		Hainan Iron Mine	Hainan, Changjiang	4,600
Do.		Handan Xingtai Metallurgical Bureau	Hebei, Handan	3,800
Do.		Tangshan Iron and Steel Co.	Hebei, Tangshan	3,000
Do.		Wuhan Iron and Steel (Group) Co. (Wugang)	Hubei, Wuhan	5,100
Do.		Banshigou Iron Mine Mining Co.	Jilin, Hunjiang	1,400
Do.		Anshan Mining Co.	Liaoning, Anshan	30,000
Do.		Benxi Iron and Steel Co.	Liaoning, Benxi	13,700

See footnotes at end of table.

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TABLE 2--Continued
CHINA: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies[1]	Location of main facilities	Annual capacity[e]
Iron and steel--Continued:			
Iron ore--Continued:	Baotou Iron and Steel and Rare Earth Co.	Nei Mongol, Baotou	10,000
Do.	Taiyuan Iron and Steel Co.	Shanxi, Taiyuan	4,000
Do.	Dabaoshan Mining Co.	Guangdong, Qujiang	1,670
Do.	Panzhihua Mining Co.	Sichuan, Panzhihua	13,000
Do.	Kunming Iron and Steel Co.	Yunnan, Kunming	1,400
Ferroalloys	Shoudu (Capital) Iron and Steel (Group) Co.	Beijing	35
Do.	Northwest Ferroalloy Co.	Gansu, Yongdeng	60
Do.	Zunyi Ferroalloy Co.	Guizhou, Zunhi	100
Do.	Jilin Ferroalloy Co.	Jilin, Jilin	250
Do.	Jinzhou Ferroalloy Co.	Liaoning, Jinzhou	90
Do.	Liaoyang Ferroalloy Co.	Liaoning, Liaoyang	70
Do.	Shanghai Iron and Steel Co. Ltd.	Shanghai	180
Do.	Emei Ferroalloy Co.	Sichuan, Emei	70
Do.	Hengshan Ferroalloy Co.	Zhejiang, Jiande	70
Crude steel	Ma'anshan Iron and Steel Co.	Anhui, Maanshan	10,000
Do.	Shoudu (Capital) Iron and Steel (Group) Co. (Shougang)	Beijing and Hebei, Caofeidian	10,000
Do.	Liuzhou Iron and Steel Group	Guangxi, Liuzhou	6,000
Do.	Handan Iron and Steel General Work (Handan)	Hebei, Handan	10,000
Do.	Tangshan Iron and Steel Co. (Taigang)	Hebei, Tangshan	2,300
Do.	Wuhan Iron and Steel (Group) Co. (Wugang)	Hubei, Wuhan	12,000
Do.	Shagang Group Co. Ltd.	Jiangsu, Zhangjiagang	13,000
Do.	Anshan Iron and Steel (Group) Co. (Angang)	Liaoning, Anshan	16,000
Do.	Benxi Iron and Steel Co. (Bengang)	Liaoning, Benxi	6,000
Do.	Baotou Iron and Steel and Rare Earth Co.	Nei Mongol, Baotou	10,000
Do.	Baoshan Iron and Steel (Group) Corp. (Baosteel)	Shanghai	19,000
Do.	Shanghai Iron and Steel Co. Ltd.	do.	6,000
Do.	Shandong Jinan Iron and Steel Group Co.	Shandong, Jinan	10,000
Do.	Shandong Laiwu Iron and Steel Group Co.	Shandong, Laiwu	10,000
Do.	Taiyuan Iron and Steel Co. (Taigang)	Shanxi, Taiyuan	5,000
Do.	Panzhihua Iron and Steel (Group) Co. (Pangang)	Sichuan, Panzhihua	6,000
Lead	Baiyin Nonferrous Metals Co. Ltd.	Gansu, Baiyin	80
Do.	Shaoguan Smelter (Shenzhen Nonfemet Co.)	Guangdong, Shaoquan	100
Do.	Hechi South Nonferrous Metals Smelting Co. Ltd.	Guangxi, Hechi	60
Do.	Anyang Smelter (Yubei Metal Co.)	Henan, Anyang	160
Do.	Jiyuan Wangyang Nonferrous Smelter	Henan, Jiaozuo	100
Do.	Jiyuan Smelter (Yuguang Gold-Lead Co. Ltd.)	Henan, Jiyuan	300
Do.	Henan Lingye Co. Ltd.	Henan, Lingbao	100
Do.	Hanjiang Smelter	Hubei, Luhekou	50
Do.	Shuikoushan Nonferrous Metals Co. Ltd.	Hunan, Hengyang	100
Do.	Zhuzhou Smelter (Zhuye Torch Metals Co. Ltd.)	Hunan, Zhuzhou	100
Do.	Xuzhou Chunxing Alloy Co. Ltd.	Jiangsu, Xuzhou	150
Do.	Kunming Smelter	Yunnan, Kunming	100
Lithium, $LiCO_3$	Sichuan Shehong Lithium Co. Ltd.	Sichuan, Shehong	2
Do.	Xinjiang Lithium Co.	Xinjiang, Urumqi	5
Magnesium	Fushun Aluminum Plant	Liaoning, Fushun	5
Do.	Ningxia Huayuan Magnesium Group	Ningxia, Yinchuan	15
Do.	Huayu Interprises (Group) Ltd.	Shanxi, Jishan	35
Do.	Taiyuan Tongxiang Magnesium Metal Co. Ltd.	Shanxi, Taiyuan	45
Do.	Taiyuan Yiwei Magnesium Co. Ltd.	do.	21
Do.	Wenxi Biyun Magnesium Co. Ltd.	Shanxi, Wenxi	30
Do.	Wenxi Yinguang Magnesium Group	do.	40
Do.	Minhe Magnesium Plant	Qinghai, Minhe	7
Manganese, metal	Chongqing Tycoon Manganese Co. Ltd.	Chongqing	23
Do.	Guangxi Dameng Manganese Industry Co. Ltd.	Guangxi, Nanning	70

See footnotes at end of table.

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TABLE 2--Continued
CHINA: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies[1]	Location of main facilities	Annual capacity[e]
Molybdenum, concentrate		Luoyang Luanchuan Molybdenum Industry Group Co., Ltd.	Henan, Luanchuan	13
Do.		Jinduichang Mining Corp.	Shaanxi, Huaxian	9
Nickel, refined		Jinchuan Nonferrous Metals Corp.	Gansu, Jinchuan	100
Do.		Chengdu Electro-Metallurgy Factory	Sichuan, Chengdu	5
Petroleum, crude		Shengli Bureau	Hebei, Shengli	33,500
Do.		Daqing Bureau	Heilongjiang, Daqing	55,000
Do.		Liaohe Bureau	Liaoning, Liaohe	15,000
Do.		Bohai Offshore Oil Corp.	Bohai	4,000
Do.		Nanhai East Corp.	Nanhai	5,000
Potash		Qinghai Yanhu Industry Group Co. Ltd.	Qinghai	40
Rare earths		Gansu Rare Earths Co.	Gansu, Baiyin	32
Do.		Jiangxi Rare Earths Co.	Jiangxi, Nanchang	1
Do.		Zhujiang Smelter	Guangdong, Guangzhou	5
Do.		Baotou Iron and Steel and Rare Earths Corp.	Nei Mongol, Baotou	25
Do.		Shanghai Yaolong Nonferrous Metals Co.	Shanghai	2
Salt		Shandong Haihua Group Co. Ltd.	Shandong, Weifang	1,400
Do.		Zigong Zhangjiaba Salt Chemical Plant	Sichuan, Zigong	250
Silver	metric tons	Daye Nonferrous Metals Co.	Hubei, Daye	100
Do.	do.	Jiangxi Copper Co. Ltd.	Jiangxi, Guixi	400
Do.	do.	Great Wall Gold Silver Refinery	Sichuan, Chengdu	300
Do.	do.	Yunnan Smelter (Yunnan Copper Group Co. Ltd.)	Yunnan, Kunming	450
Strontium, carbonate		Chongqing Chonglong Strontium Co. Ltd.	Chongqing	20
Do.		Chongqing Tongliang Redbutterfly Strontium Co.	do.	120
Do.		Hebei Xinji Chemical Group	Hebei, Xinji	35
Do.		Nanjing Jinyan Strontium Co. Ltd.	Jiangsu, Lishui	20
Talc		China National Nonmetallic Industry Corp.	Guangxi, Longshen	130
Do.		do.	Liaoning, Haicheng	50
Do.		do.	Shandong, Qixia	5
Tin, smelter		Laibin Smelter [Huaxi (China Tin) Group Co.]	Guangxi, Laibin	25
Do.		Pinggui Mining Bureau	Guangxi, Zhongshan	8
Do.		Yunnan Tin Industry Co.	Yunnan, Gejiu	55
Titanium, sponge		Zunyi Titanium Plant	Guizhou, Zunyi	10
Do.		Fushun Aluminum Plant	Liaoning, Fushun	3
Tungsten, concentrate		Shizhuyuan Nonferrous Metals Co.	Hunan, Chenzhou	5
Do.		Yaogangxian Tungsten Mine	Hunan, Yizhang	3
Do.		Nanchang Co.	Jiangxi, Nanchang	15
Zinc		Northwest China Lead-Zinc Smelter (Baiyin Nonferrous Metals Co. Ltd.)	Gansu, Baiyin	150
Do.		Shaoguan Smelter (Shenzhen Nonfemet Co.)	Guangdong, Shaoquan	170
Do.		Liuzhou Zinc Products Factory	Guangxi, Liuzhou	100
Do.		Yugang Gold-Lead Co. Ltd.	Henan, Jiyuan	100
Do.		Shuikoushan Nonferrous Metals Co. Ltd.	Hunan, Hengyan	60
Do.		Zhuzhou Smelter (Zhuye Torch Metals Co. Ltd.)	Hunan, Zhuzhou	300
Do.		Huludao Zinc Smelting Co.	Liaoning, Huludao	390
Do.		Laibin Smelter	Yunnan, Laibin	60
Do.		Yunnan Jinding Zinc Co. Ltd. (Sichuan Hongda Group)	Yunnan, Lanping	100
Do.		Yunnan Chihong Zinc and Germanium Co. Ltd.	Yunnan, Qujing	100

[e]Estimated; estimated data are rounded to no more than three significant digits. NA Not available.
[1]Companies are owned by either a State government or a Provincial government.

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TABLE 3
CHINA: EXPORTS OF SELECTED MINERAL COMMODITIES IN 2005

	Quantity (metric tons)	Value (thousands)
METALS		
Aluminum:		
Alumina	20,000	$13,861
Metal and alloys:		
Unwrought	1,318,599	2,379,523
Semimanufactures	711,484	1,950,894
Antimony metal, unwrought	29,833	82,922
Barium sulfate	3,080,000	106,954
Bismuth, includes powder, unwrought, and waste	6,840	50,194
Copper, metal and alloys:		
Unwrought	144,671	549,823
Semimanufactures	463,560	2,073,660
Iron and steel:		
Ferrosilicon	940,000	614,018
Pig iron and cast iron	2,230,000	666,508
Steel:		
Bars and rods	6,100,000	2,769,382
Shapes and sections	900,000	446,751
Sheets and plates	8,450,000	5,223,095
Tube and pipe	840,000	1,150,353
Magnesium metal, unwrought	181,925	295,867
Manganese, unwrought	285,019	424,333
Tin, metal and alloys, unwrought	27,014	198,648
Tungsten, tungstates	8,012	135,566
Zinc:		
Metal and alloys, unwrought	146,845	195,826
Oxide and peroxide	62,205	69,202
INDUSTRIAL MINERALS		
Cement	22,160,000	684,600
Fluorspar	730,000	128,785
Granite	5,250,094	1,276,414
Graphite, natural	493,747	85,447
Magnesia, fused	361,094	133,182
Talc	560,000	70,513
MINERAL FUELS AND RELATED MATERIALS		
Coal	71,680,000	4,272,138
Coke, semicoke	12,760,000	2,340,584
Petroleum:		
Crude oil	8,070,000	2,696,013
Refinery products	14,010,000	6,410,828

Source: General Administration of Customs of the People's Republic of China, 2005, China monthly exports and imports, no. 12.

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TABLE 4
CHINA: IMPORTS OF SELECTED MINERAL COMMODITIES IN 2005

(Metric tons unless otherwise specified)

		Quantity	Value (thousands)
METALS			
Aluminum:			
Alumina		7,020,000	$2,597,174
Metal and alloys, unwrought		636,951	1,018,491
Semimanufactures		647,589	2,251,015
Scrap		1,687,210	1,368,589
Chromium, chromite		3,020,000	595,569
Cobalt, ore and concentrates		119,146	282,911
Copper:			
Ore and concentrates		4,060,000	3,706,722
Anode		129,244	463,056
Metal and alloys, unwrought		1,415,029	4,949,672
Semimanufactures		1,118,729	4,378,236
Scrap		4,821,214	3,179,905
Iron and steel:			
Iron ore		275,260,000	18,372,783
Steel:			
Bars and rods		1,090,000	1,015,102
Scrap		10,140,000	2,610,486
Seamless pipe		1,090,000	2,291,909
Shapes and sections		640,000	332,227
Sheets and plates		22,430,000	20,114,588
Manganese ore		4,580,000	683,483
Nickel:			
Ore and concentrates		483,888	176,292
Metal		89,684	1,321,974
Titanium dioxide		227,655	417,775
INDUSTRIAL MINERALS			
Diamond	kilograms	3,229	1,944,430
Fertilizers:			
Compound fertilizers		4,100,000	1,039,048
Diammonium phosphate		1,750,000	497,375
Potassium chloride		8,830,000	1,824,137
Potassium sulfate		190,000	43,311
Urea		70,000	12,715
Sodium carbonate		70,549	12,761
MINERAL FUELS AND RELATED MATERIALS			
Coal		26,170,000	1,383,686
Petroleum:			
Crude oil		126,820,000	47,722,927
Refinery products		31,430,000	10,434,649

Source: General Administration of Customs of the People's Republic of China, 2005, China monthly exports and imports, no. 12.

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The Mineral Industry of East Timor (Timor-Leste)

By Pui-Kwan Tse

East Timor (Democratic Republic of Timor-Leste) has a landmass of 15,000 square kilometers and is located on the eastern part of the island of Timor. On the west is the Indonesian Province of Nusa Tenggara Timur; Australia is situated 500 kilometers south across the Timor Sea. After being ruled by Portugal for more than 400 years followed by 25 years of violent transition from Indonesia and 2.5 years of United Nations administration, East Timor became independent on May 20, 2002. During the transition, the country's infrastructure was severely damaged, and people were relocated to other places. The country had a population of less than 1 million people in 2004. After the United Nations civil administration and peacekeeping operations withdrew from the country, the economy contracted by 2.7% in 2003. The country's real gross domestic product (GDP) growth was positive in 2004 and 2005 and the real GDP was expected to continue to grow by about 2% in the next several years (Asian Development Bank, 2005a, p. 4).

East Timor was considered a highly prospective area for natural gas and oil. The Government counted on the oil and gas sector to contribute a significant portion of its revenues to the budget. In 2003, the Governments of Australia and East Timor signed the International Unitization Agreement (IUA) and a related memorandum of understanding for the Greater Sunrise field, which is located at the eastern perimeter of the Joint Petroleum Development Area established under the Timor Sea Treaty. Under the IUA, East Timor will receive 18% of the total Government revenues from the field, and Australia will receive 82%. Australia will pay East Timor $1 million per year during the construction phase of the Greater Sunrise development and $10 million when the facility is put into operation. The IUA was terminated when the Treaty on Certain Maritime Agreements in the Timor Sea was signed between the Governments of Australia and East Timor in January 2006. Under the new treaty, the two countries will share the "upstream" revenues from the Greater Sunrise field equally. Allocation of the "downstream" revenues from refining will be determined later. The Greater Sunrise field was operated by a partnership of ConocoPhillips Company, Osaka Gas Company, Royal Dutch/Shell Group, and Woodside Energy Company. The field was estimated to have 220 billion cubic meters of natural gas and 300 million barrels of condensate reserves (ETAN News, 2006§[1]).

The Bayu-Undan field, which is in the Timor Sea Treaty area, started production of condensate in February 2004. ConocoPhillips was the operator. The gas was separated from the liquid and reinjected back into the reservoir. The liquid was transported to the floating processing and storage facility *Liberdade* and the petroleum products were sold on the open market. The gas will be extracted from the reservoir and transported to the Darwin liquefied natural gas (LNG) plant in Australia through a pipeline in 2006. The construction costs for the LNG plant and the pipeline were estimated to be about $1 billion and $500 million, respectively. The field was estimated to contain 96 billion cubic meters of natural gas and 400 million barrels of condensate reserves (Petroleum Transparency, 2005§). ConocoPhillips signed agreements to supply 3 million metric tons per year of LNG to Japanese Tokyo Electric Power Co. and Tokyo Gas Co. Ltd. for 17 years. In 2004, the East Timor Government received about $41 million in revenue from the gas and oil sector. The revenue was expected to increase to $243 million in 2005 (Asian Development Bank, 2005b, p. 2).

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The Mineral Industry of Fiji

By Travis Q. Lyday

The Republic of the Fiji Islands is an island group, or archipelago, comprised of more than 800 islands and islets, of which only about 110 are inhabited. The Fiji archipelago is part of Oceana and is located about two-thirds of the way from Hawaii to New Zealand, or about 4,450 kilometers (km) southwest of Honolulu and 1,770 km north of New Zealand (U.S. Department of State, 2005§[1]; U.S. Central Intelligence Agency, 2006§). Fiji's capital city is Suva, which is on Viti Levu, the largest of the country's four main islands. The others, in decreasing size, are Vanua Levu, Taveuni, and Kandavu. Other major cities include Lautoka and Nadi on Viti Levu, and Labasa and Savusavu on Vanua Levu. Fiji's total land area is 18,270 square kilometers (km^2), which is slightly smaller than New Jersey. Fiji has zero water area and zero land boundaries. Fiji has 1,129 km of coastline (U.S. Central Intelligence Agency, 2006§). Fiji's population of nearly 900,000 includes native Fijians (5.1%), which are a mixture of Melanesian and Polynesian peoples and East Indians (4.4%); the remainder is a combination of peoples of European, other Pacific islander, and Chinese descent (Resource Information Unit, 2006, p. 15).

The country's gross domestic product (GDP) based on purchasing power parity was estimated to be $5.409 billion in 2005. The estimated real GDP growth rate based on purchasing power parity was 2% (U.S. Central Intelligence Agency, 2006§).

Fiji was one of the most developed of the Pacific Island economies in 2005, although it remained a developing country with a large subsistence agriculture sector. Fiji also had the greatest political instability in the Asia and the Pacific region (Resource Information Unit, 2006, p. 15). Australian companies were the leading foreign investors in Fiji, where gold was the main mineral attraction, followed by byproduct silver. Sugar exports and a growing tourist industry, which hosted between 300,000 and 400,000 tourists annually, were the major sources of foreign exchange. Sugar processing composed up to one-third of Fiji's industrial activity, but the industry remained inefficient (U. S. Department of State, 2005§).

Commodity Review

Exploration licenses within Fiji are granted for aggregate, base metals, bauxite, gold, limestone, marble, natural gas, and petroleum (Resource Information Unit, 2006, p. 15).

Emperor Mines Ltd, which was headquartered in Sydney, Australia, and listed on the Sydney stock exchange, has dominated the Fiji mining sector for 70 years, with continuous operation of the epithermal Vatukoula gold-silver mine from which more than 20,000 metric tons of gold have been mined since the mid-1930s (Resource Information Unit, 2006, p. 2). While fiscal year 2005 production levels essentially were maintained at the Emperor Mine, the need to meet changing operational requirements and contain costs led the company to announce in December 2005 its intention to lay off 374 members of its workforce. The general manager of the Emperor Mine was quoted as saying that rising costs, especially oil prices, had contributed to the decision to lay off staff. One week following the layoff announcement, Fiji's Mine Workers Union announced that Emperor Mines had agreed to reinstate 141 of the newly redundant staff. The union had threatened to strike after the company announced its redundancy plan (Resource Information Unit, 2006, p. 2).

The original Emperor Mine was located on the western flank of the Tavua volcanic caldera about 14 km from the northwest coast of Viti Levu. The current 2005 operation is a multishaft (four) underground gold-silver mine that produces about 4,000 kilograms of gold annually (Resource Information Unit, 2006, p. 2). Future capital spending programs at the Vatukoula mine will include refurbishment of the Phillip Shaft to increase capacity and feasibility studies and test work to construct a fluidized bed roaster to assist in processing ore with higher sulfur levels and reduce emissions, by which the company hoped to achieve a return to cash positive operations.

In addition to the Vatukoula project, Emperor held a 100% interest in the Tuvatu tenements, which are located just 50 km south of Vatukoula. In February 2005, Emperor entered into an agreement with Perth, Australia-based Alcaston Mining NL for Alcaston to acquire Emperor's interests in the Tuvatu tenements. Alcaston had until the end of January 2006 to complete the acquisition of the Tuvatu gold project under which Emperor would receive cash and shares in Alcaston in exchange for the project. Emperor granted numerous extensions to Alcaston Mining and agreed to amend the terms during the course of 2005 to enable Alcaston to put in place appropriate financing to complete the transaction and to fund working capital for a bankable feasibility study for possible further exploration at Tuvatu. In January 2006, the Board of Emperor Mines considered the latest revised financing terms proposed by Alcaston to be unacceptable and the agreement was terminated (Emperor Mines Ltd., 2006§).

Another major Fiji mine was the Mt. Kasi open-cut gold mine on the south coast of Vanua Levu. Pacific Islands Gold (Fiji) Ltd. briefly operated the mine from early 1996 until mid-1998, after which the mine was placed on care and maintenance status. Financial difficulties, which were exacerbated by falling gold prices, were cited as the main contributors to the early closure of the mine.

BlueScope Lysaght Fiji Ltd, a subsidiary of BlueScope Steel Ltd. of Australia, had roll-forming operations at Suva and Lautoka.

Outlook

For at least the next decade, Fiji's mining sector is expected to remain reliant on the mining of gold and associated silver

[1]References that include a section mark (§) are found in the Internet References Cited section.

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from the Vatukoula Mine. The Tavua Basin and Tuvatu gold prospects, which are located just a few kilometers to the northeast of Nadi and close to the Vatukoula Mine, have been exploration targets with viable results for the past few years.

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Major Source of Information

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TABLE 1
FIJI: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

Commodity[3]		2001	2002	2003	2004	2005
Cement, hydraulic	metric tons	95,000 [4]	95,000 [r]	95,000 [r]	100,000 [r]	100,000
Gold, mine output, Au content	kilograms	4,430 [r]	3,840 [r]	3,836 [r, 4]	3,731 [r, 4]	3,800
Silver, mine output, Ag content	do.	2,130 [r]	1,480 [r]	1,974 [r, 4]	1,901 [r, 4]	1,500

[r]Revised.

[1]Estimated data are rounded to no more than three significant digits.

[2]Table includes data available through June 20, 2006.

[3]In addition to the commodities listed, bauxite, crushed and dimension stone, limestone/marble, sand, sand and gravel, and sand for cement manufacture were produced, but data are insufficient to make reliable estimates of output.

[4]Reported figure.

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THE MINERAL INDUSTRY OF INDIA

By Chin S. Kuo

India is endowed with a variety of mineral resources and the mineral industry constituted an important sector of the Indian economy. The country's gross domestic product (GDP) based on purchasing power parity increased by 8.3% to $3,633 billion in 2005. India's GDP growth was attributed largely to a rise in the service sector (50.8%) that was owing mainly to increased information technology outsourcing. Industry (27.2%) and agriculture (22%) also contributed to the 2005 economic performance. The inflation rate was moderate at 4.2% (International Monetary Fund, 2006§[1]). The mineral industry produced metal and a large amount of industrial minerals and was characterized by many small-scale mining operations. India was the leading producer of mica in the world. The country ranked third in the production of barite, chromite, and coal and lignite. Foreign investment in India was particularly sought after in mining and petroleum exploration and processing, and in such infrastructure projects as ports, power generation, roads, and telecommunications.

Government Policies and Programs

The Government decided that foreign equity holding was allowed up to 100% automatically for all nonfuel and nonuranium minerals, including diamond and precious stones. The Government also introduced a Federal value-added tax (VAT) in April 2005 that replaced a complex web of Indian state sales taxes. The VAT formed the centerpiece of the Government's tax measures to simplify the system and raise revenue for cash-strapped regions. Eight states opposed the tax but a majority of India's 29 states had adopted the tax by the end of 2005 (Wall Street Journal, The, 2005).

The Government decided to ban the import of scrap metal from countries that adjoin war zones worldwide, such as Iran and several Middle East countries, to ensure that military wastes do not get into scrap consignments. A live rocket hidden in iron scrap imported from Iran accidentally went off in the vicinity of Ghaziabad, State of Uttar Pradesh, in 2004. Dozens of live shells were found in consignments meant for Bhushan Steel Co. Ltd. in the Sahibabad industrial district. India was a major importer of metal scrap, including aluminum, iron, and zinc (Metals Place, 2004§).

The Government approved a plan to establish a strategic petroleum reserve of 5 million metric tons (Mt). Of the reserves, 1.5 Mt would be stored at Mangalore, State of Karnataka, 1 Mt at Vizag, State of Andhra Pradesh, and 2.5 Mt at a location yet to be determined. India Strategic Petroleum Reserves was to manage the reserve. Construction of the Mangalore and the Vizag facilities would cost $313 million (Petroleum Economist, 2005c).

[1]References that include a section mark (§) are found in the Internet References Cited section.

Commodity Review

Metals

Aluminum.—Dubai Aluminium Co. was to set up a joint venture with India's Larsen & Toubro Ltd. to build a bauxite mine and an alumina refinery in the State of Orissa. The $1 billion project consisted of a 1.4-million-metric-ton-per-year (Mt/yr) alumina refinery, a bauxite mine, and the development of associated infrastructure, including a captive powerplant, a port facility, a township, and related utilities. The refinery was expected to be commissioned in 2009. Dubai Aluminium Ltd. would hold an equity stake of 74% in the project. During the second phase of the project, a doubling of the alumina refinery's capacity to 2.8 Mt/yr was planned. The second phase also would include the construction of an aluminum smelter. The capacity of the proposed smelter was not decided (ABQ Zawya Ltd., 2005§).

Jindal South West (JSW) Group planned to enter the aluminum sector by building a 1.5-Mt/yr alumina refinery and a 250,000-metric-ton-per-year (t/yr) aluminum smelter near Visakhapatnam, State of Andhra Pradesh. The total investment would be $2 billion. The capacity of the alumina refinery would reach 600,000 t/yr in the first stage. JSW also might construct a 650-megawatt (MW) powerplant. Andhra Pradesh Mineral Development Corp. would supply bauxite to the plant. Reserves in the State totaled 240 Mt. The project could employ 10,000 workers directly and indirectly when it was completed (Metal Bulletin, 2005a).

Vedanta Resources plc approved a $2.1 billion greenfield 500,000-t/yr aluminum smelter project with an associated 1,215-MW captive thermal powerplant at Jharsuguda, State of Orissa. Upon completion, the company's total aluminum smelting capacity would reach 900,000 t/yr. The Jharsuguda project would comprise two potlines, each of which would contain 288 cells. Construction of the first phase of 250,000-t/yr capacity beginning in June 2006 was expected to be completed in mid-2009. The second phase of 250,000-t/yr capacity was expected to be completed by yearend 2010. The associated thermal powerplant would comprise 9 units of 135 MW each. Meanwhile, Vedanta's greenfield 1-Mt/yr to 1.4-Mt/yr alumina refinery in the State of Orissa was scheduled to be commissioned in 2007 (London Stock Exchange, 2005d§).

Copper.—Pebble Creek Resources Ltd. of Canada applied for a mining lease in March for the Askot volcanogenic massive sulfide deposit, which is located in Pithoragarh district in the State of Uttaranchal. Previous work included 9,000 meters (m) of drilling and 1,200 m of exploratory underground workings. The deposit dipped steeply northeast, had a strike length of 550 m, and was open to the northwest. Total mineral resources were estimated to be between 10 Mt and 20 Mt, of which 1.7 Mt were indicated resources at grades of 2.53% copper, 6.07% zinc, and 3.85% lead with some gold and silver. A prefeasibility

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study earlier called for a 210,000-t/yr underground mine. The company expected production to begin in 2007 (Pebble Creek Resources Ltd., 2006§).

Iron Ore and Iron and Steel.—India was the world's third ranked supplier of iron ore mainly to China, Europe, Japan, and the Republic of Korea. About two-thirds of the iron ore shipped, or 78 Mt, was exported to China in 2005. India sold about 80% of its iron ore in spot deals and 20% under long-term contracts. The average export price of iron ore was $45 per metric ton free on board at a grade of 64% iron content in 2005 (Reuters, 2005§).

With new investments of $2.2 billion in the iron and steel sector, the State government of Chhattisgarh wanted National Mineral Development Corp. to restrict iron ore exports from the Bailadila Mines to Japan and other countries. The Bailadila Mines had 50% of the iron ore deposits in the State, of which nearly 30% was exported to China and Japan. In addition, several iron and steel plants in the State were facing a shortage of raw material and had imported iron ore from the States of Jharkhand and Orissa (Financial Express, 2005b§).

As part of its expansion plans, Tata Steel Co. Ltd. proposed to acquire some of the coal mines owned by Bharat Coking Coal Ltd., which was the loss-making public sector unit. The Ministry of Coal was willing to lease out unviable mines to the private sector for captive purposes. A company with steel production was eligible for captive mining of coal (Business Standard, 2005§).

JSW Steel Co. Ltd. was in the process of expanding its steel production capacity to 3.8 Mt/yr from 2.5 Mt/yr. In addition, the company planned to construct a 2.8-Mt/yr blast furnace at its Vijayanagar steel plant in the southern part of the State of Karnataka. Siemens VAI was awarded the construction project. The expected capital cost of the furnace is $1.09 billion. When the new blast furnace is completed in 2008, Vijayanagar's capacity will be increased to 7 Mt/yr. In the second stage of expansion, the steel plant's capacity will increase to 10 Mt/yr in 2011. The company also planned to build a 10-Mt/yr steel plant with an investment of $7.63 billion in Saraikela Kharswan district in the State of Jharkhand (Platts, 2005c§).

The State government of Orissa and Pohang Iron and Steel Co. Ltd. (Posco) of the Republic of Korea reached an agreement in June for Posco to build a $12 billion 13-Mt/yr steel plant at Paradip in the State of Orissa. The plant was scheduled to start producing steel in July 2009. Posco could gain access to as much as 660 Mt of iron ore during the next 30 years beginning in 2009. Posco's partner BHP Billiton plc pulled out of the project after refusing to accept conditions laid down by the State government. In October, Mittal Steel Co. of the Netherlands reached a deal with the State of Jharkhand to set up a 13-Mt/yr steel mill. Tata Steel planned to add 31 Mt/yr of steel capacity to its existing 5.5 Mt/yr at Jamshedpur (Barta and Glader, 2005).

Mittal Steel planned to build a $6.9 billion steel plant and iron ore mine in the State of Jharkhand, which held 23% of India's untapped iron ore reserves. Jharkhand together with the States of Chhattisgarh and Orissa accounted for 55% of India's iron ore reserves and 70% of its coal reserves. Jharkhand currently (2005) supplied iron ore to Tata Steel, which was India's second ranked steelmaker. The plant would produce 10 Mt/yr of crude steel, which would make it the fourth largest steel plant, in terms of annual production, in the world (Bloomberg.com, 2005§).

Jindal Stainless Ltd. commissioned the first phase of its new ferroalloy operation in March. The company constructed a furnace at Duburi in the State of Orissa with a production capacity of 150,000 t/yr of ferrochrome. The second phase would include the installation of a furnace with a production capacity of 40,000 t/yr of ferromanganese and a furnace with a production capacity of 60,000 t/yr of silicomanganese. The company also would build a waste-heat recovery powerplant, which was expected to be completed in 2006 (Metal-Pages, 2005§).

Production of ferroalloy and special steel was brought to a halt at Mukand Ltd.'s Kalwe plant in July owing to floods. Grasim Industries Ltd.'s 900,000-t/yr Vikram Ispat hot-briquetted iron works was operating at 70% of capacity owing to continued disruption to its supply of naphtha and propane gas. Ispat Industries Ltd.'s direct-reduced iron works was yet to return to full production owing to the continued shortage of gas (Metal Bulletin, 2005b).

Platinum.—Platinum Mining Corp. of India plc signed a drilling contract with Mining Associates of India for an initial 5,000-m drilling program to begin in November at the Boula platinum deposit in the district of Keonjhar, State of Orissa. An extensive program of channel sampling also was started. Bureau de Recherches Geologiques et Minieres of France reported an indicated and inferred mineral resource of 14.2 Mt with a combined platinum and palladium grade of 1.5 grams per metric ton (g/t) based on a cutoff grade of 0.5 g/t (London Stock Exchange, 2005b§).

Titanium.—Stork Handelsges mbH of Austria was in talks with State-owned Andhra Pradesh Mineral Development Corp. (APMDC) prior to drafting a memorandum of understanding to set up a titanium project. The project was to be based in Srikakulam district and would involve the mining of beach sand and the commissioning of a mineral separation, titanium slag, and sponge plant. The plant would produce 250,000 t/yr of ilmenite through the third year of operation and 500,000 t/yr from the fourth year onwards. Stork indicated an investment of $150 million in collaboration with JSC Corp., which was a leading Russian titanium producer. An area of 25 square kilometers (km^2) in Bhavanapadu and Kalingapatnum was expected to be alloted to APMDC, which planned to apply for a mining lease in association with Stork (Industrial Minerals, 2005d).

The Government withdrew the export license of Earth Mineral Resources Ltd. which was the producer of ilmenite concentrate sold by WGI Heavy Minerals Inc. As a result, WGI declared force majeure on its 3-year agreement of August 2003 to supply 40,000 t/yr of ilmenite to a major pigment producer. WGI's operations included mining and processing facilities in the States of Andhra Pradesh and Tamil Nadu (Canada NewsWire, 2005).

Zinc.—The $425 million major expansion project at Hindustan Zinc Co. Ltd.'s (Vedanta Resources plc owned 64.9%) zinc facilities at Chanderiya in the State of Rajasthan was completed on schedule, and trial production began. The expansion increased the refined zinc capacity by 170,000 t/yr

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to 402,000 t/yr. The project also included the construction of a 154-MW coal-fired captive powerplant and the expansion of mine output to 3.75 Mt/yr from 2.3 Mt/yr. The reserves at the Rampura Agucha Mine also increased by 25% to 51.1 Mt that contains 12.8% zinc and 1.9% lead following a drilling program. The mine life was extended by another 3 years. A second $300 million 170,000-t/yr smelter would be built at Chanderiya in early 2006 to increase total capacity to 572,000 t/yr (London Stock Exchange, 2005a§).

Industrial Minerals

Cement.—The Indian cement industry had approximately 128 large cement plants with a combined capacity of 153 Mt/yr. The capacity utilization levels remained in the range of between 80% and 84%. About 98% of the industry capacity was owned by the private sector. The per capita cement consumption was 110 kilograms in 2005. Infrastructure development, new commercial projects, the housing sector, and capital expenditure were the main sources of demand for cement. In 2005, Holcim-Ambuja acquired India's leading cement company, ACC Ltd., which had a capacity of 18 Mt/yr (World Cement, 2005).

Diamond.—The Ministry of Commerce proposed that the import tax on polished diamond and colored gemstones be reduced to 0% from 5%. Losses of Government revenue from the tax exemption were projected to be $63 million for diamond and $520,000 for colored stones. A cut in the import duty on diamond was among the 100 budget proposals put forward by the Ministry (Antwerp Facets News Service, 2005b§).

Dwyka Diamonds Ltd. began sampling on two permit areas in the States of Karnataka and Madhya Pradesh that cover 4,000 km^2. A limited number of samples contained indicator minerals derived from kimberlites. Intensive geophysical exploration and drill testing were planned for the vicinity of the Chigichera cluster of kimberlites, and the site of several untested targets (London Stock Exchange, 2005c§).

Rio Tinto Ltd. of Australia discovered diamondiferous kimberlite pipes at its Bunder prospect in the Chhatarpur district, State of Madhya Pradesh. The kimberlite pipes were found in six drill holes. The 8,687-km^2 Chhatarpur district is adjacent to the Panna district, where a closed diamond mine had been run by the National Mineral Development Council of India (Antwerp Facets News Service, 2005a§).

Mica.—India was the leading producer of natural sheet mica in the world. The State of Andhra Pradesh had one of the world's largest deposits of muscovite mica. Micafab India Pvt. Ltd. in the State of Andhra Pradesh mined ruby sheet muscovite and green muscovite at Sydapuram Mandal in Nellore district. Output was 4,500 t/yr and the main export markets were China, Europe, and the United States. Premier Mica Co., which was located in the State of Andhra Pradesh, mined mica from its Bhavani Shankara Mine at Rjupalem in Nellore district to produce 200 t/yr of mica flakes (Industrial Minerals, 2005b).

Nitrogen.—Rashtriya Chemicals and Fertilizers Ltd. planned to invest $453 million in a new 1-Mt/yr ammonia production line. The expansion project at Thal in the State of Maharashtra was scheduled to be completed in 3 years. The unit was expected to use natural gas as its production feedstock. The project also included two other production lines of ammonia, which had capacities of 445,000 t/yr each, and two urea units, which had capacities of 907,000 t/yr and 852,000 t/yr, respectively (Fertilizer Week, 2005a).

Phosphate Rock.—Oswal Chemicals & Fertilizers Ltd. has come under the spotlight on pollution control issues at its Paradip phosphates operation off-and-on since the plant started up in May 2000. The issues concerned excessive particulate matter emissions from its captive powerplant at Paradip. The company was asked to halt operation of one of the two coal-fired boilers and to undertake repair work on the electrostatic precipitator (the pollution control device) (Fertilizer Week, 2005b).

Refractory Materials.—Vesuvius India Ltd. planned to double the production capacity of refractories in each of its three plants. This was to meet the growing demand from the domestic steel industry. The cost of the expansion was expected to be more than $32 million. At the Kolkata plant, production was being doubled to 1,600 pieces per day of flow control refractories. Production at the Vizag plant was to increase to 5,000 metric tons per month (t/mo) from 3,000 t/mo to serve the iron and steel industry. At Mehsana, capacity would be doubled from 110 t/mo by 2006 to serve the aluminum and foundry sectors (Industrial Minerals, 2005e).

Salt.—Hindustan Salts Ltd. began a feasibility study for the production of caustic soda, chlorine, and salt from rock salt deposits at Mandi in the State of Himachal Pradesh. Production capacity was planned for 60,000 t/yr of caustic soda. The company planned to use solution mining, thermo-compression, and membrane electrolysis for the production of chloralkali and salt derivatives. The cost of power in the State was low compared to the rest of the country. The salt formations in the area were the only known deposits of rock salt in India. The proven salt reserves at Drang were estimated to be 100 Mt and the mines produced 3,000 t/yr of salt in 2005 (Industrial Minerals, 2005a).

Soda Ash.—GHCL Ltd. planned to almost double the 600,000-t/yr capacity of its Sutrapada soda ash plant in Junagadh district, State of Gujarat, in the next 4 years. The first phase would increase capacity by 200,000 t/yr in 15 to 18 months, followed by an expansion of 300,000 t/yr during the next 30 months. The total capacity would be brought to 1.1 Mt/yr of soda ash. The company had captive resources of limestone and salt that could be used to boost the capacity further (Industrial Minerals, 2005c).

Mineral Fuels

Coal.—State-owned Coal India Ltd. (CIL) planned to raise its coal output to 363.8 Mt in 2006 and to 504.1 Mt in 2011. CIL also had an emergency coal production plan for an additional 71.3 Mt from 16 identified opencast projects and mines. Owing to limited reserves of coking coal, imports would be required to fill the gap between demand and supply. Indian coking coal had a high ash content and had to be blended with imported coking coal (Platts, 2005a§).

Natural Gas.—The Government planned to import natural gas by a $7 billion 2,735-kilometer (km) pipeline from Iran via

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Pakistan and signed the deal by the end of 2005. Ernst & Young LLP was hired to act as a consultant on the deal. Construction of the pipeline was expected to begin in 2007. India was the world's sixth leading energy consumer and was expected to increase its energy use by 4% per year. Demand for natural gas was projected to more than double by 2025 (Lancaster, 2005). Iran signed a deal with India in June to supply India with 5 Mt/yr of liquefied natural gas for 25 years beginning in 2010 (Iran Daily, 2005).

Petroleum.—The new exploration and licensing policy aimed to stimulate domestic output by openly encouraging foreign companies to bid on upstream projects. In January, the Government initiated the fifth licensing round and offered for bid 8 offshore blocks, which included 6 in deep water, and 12 onshore blocks in the Krishna-Godavari basin and in the States of Rajasthan and Gujarat. The bidding was closed on May 31, 2005. Indian petroleum subsidies were gradually being phased out. Foreign oil companies were allowed 100% cost recovery and could repatriate all their profits in U.S. dollars. There was no mandatory requirement for state participation and no minimum expenditure during the exploration period of a contract (Petroleum Economist, 2005e).

A joint venture between Gas Authority of India Ltd. and Gazprom of Russia (50% each) began drilling in Bengal basin in October. The joint venture invested $13 million in Block 26 and was expected to spend another $30 million to drill the first well. Block 26 is located 100 km southeast of Haldia in the State of West Bengal. Gazprom was the operator of the project (Petroleum Economist, 2005d).

Gujarat State Petroleum Corp. discovered a new oilfield in the onshore Tarapur oil and gas exploration block, which is located in Anand district near Ahmedabad in the State of Gujarat. The oil reserves, which were found at a depth of 1,490 m, were estimated to be between 5 million and 7 million barrels. The company initially teamed up with Hindustan Oil Exploration Co. to carry out more-detailed and deeper geologic and geophysical surveys. The first well was drilled in February and yielded oil at a depth of 1,500 m. The company planned to drill three or four more wells in the near vicinity of the strike in 2005 (Financial Express, 2005a§).

Current (2005) output of 520,000 barrels per day (bbl/d) from Oil and Natural Gas Corp.'s (ONGC) fields could fall sharply in the future and the company planned to double its reserves to 12,000 Mt in 2020 by focusing on new discoveries and better technology. ONGC also was increasingly looking abroad to develop new energy supplies. Nearly 20% of India's estimated oil reserves remained undiscovered. In the past, ONGC had discovered five out of India's six oil-producing basins. India imported 100 Mt/yr of crude oil to supplement the domestic crude oil output of 33.5 Mt/yr. The Government planned to import 20 Mt of coal in 2006 to supplement its energy needs (BBC News, 2005§).

Production of oil and gas by ONGC in the State of Assam was affected owing to disruption caused by the All Assam Students Union. ONGC shut down the producing wells in the Geleki, the Lakwa, and the Rudrasagar fields in May. These wells might not be revived when operations resume. ONGC was the biggest employer in terms of revenues in the State of Assam and planned to invest $442 million during a 4-year period beginning in 2005 to revive and rejuvenate its fields in the State of Assam (Rigzone.com, 2005§).

ONGC began work on the G1-GS15 oil and gas development in the offshore Krishna Godavari basin. The fields were expected to come onstream in 2006 and to produce 1 Mt of low-sulfur crude oil and 6 billion cubic meters of gas during 15 years. Clough Engineering Ltd. of Australia was awarded the $215 million contract for the development project (Petroleum Economist, 2005a).

ONGC also planned to build a 3-Mt/yr refinery in the State of Rajasthan to process crude oil from Cairn Energy plc of the United Kingdom's discoveries in the region. The refinery was expected to cost $1.13 billion and was designed for future expansion to 5 Mt/yr. ONGC had the right to take a 30% stake in all Cairn Energy's discoveries in the State of Rajasthan (Petroleum Economist, 2005a).

The Government looked into expanding the capacity of Hindustan Petroleum's Visakhapatnam refinery and the proposed Indian Oil Corp.'s refinery at Paradip. Indian Oil was to set up a refinery in Barmer district, State of Rajasthan, where Cairn Energy found oil at its N-V field to be between 250 million and 350 million barrels (Petroleum Economist, 2005b).

Indian Oil commissioned a hydrocracker as part of the $950 million expansion project to double the production capacity of its Panipat refinery in the State of Haryana to 12 Mt/yr. At Panipat, a hydrogen generation unit and a diesel hydrotreater were commissioned in 2005. The expansion project would be completed by March 2006. Indian Oil had two other hydrocrackers; one was at the Koyali refinery in the State of Gujarat, and the other, at the Mathura refinery in the State of Uttar Pradesh (Platts, 2005b§).

Infrastructure

In 2005, the State of Maharashtra experienced severe power shortages. The almost-completed $2.9 billion Dabhol power project, which is located 177 km south of Mumbai and was once owned by Enron Corp. of the United States, received support for plans to resurrect the facility. Bechtel Group Inc. and General Electric Co., which together had acquired Enron's 65% stake in the project in 2004, and other lenders were negotiating to sell their investment to a group of Indian financial institutions. If revived, the powerplant could produce 2,184 MW of electricity when operating at full capacity (Larkin, 2005).

Reliance Energy Ltd. planned to build an $11 billion 12,000-MW coal-fired powerplant in the State of Orissa and a $2.53 billion powerplant in the State of Uttar Pradesh. Its parent company, Reliance Industries Ltd., agreed to supply natural gas to the latter project from the massive deposits discovered by Reliance Industries off India's east coast (Larkin and Bellman, 2005).

Outlook

India's current steel capacity was between 40 Mt/yr and 50 Mt/yr. With favorable regulatory and investment conditions, planned expansions by JSW Steel Co. Ltd., Mittal Steel, Posco,

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Tata Steel, and others are expected to add a combined 80 Mt/yr to the country's steel production capacity in the future. India is expected to become one of the major steel producers in the world. Indian steel consumption is forecasted to increase to between 80 Mt and 100 Mt by 2015 and to 110 Mt in 2020. With the completion of the Dabhol power project and Reliance Energy's planned powerplants, India's power generation capacity is expected to reach 254,000 MW by 2015. However, the power requirement is going to remain a constraint on the development of the country's aluminum industry in the near future.

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TABLE I

INDIA: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Commodity[3]		2001	2002	2003	2004	2005
METALS						
Aluminum:						
Bauxite, gross weight	thousand metric tons	7,864 [4]	9,647 [4]	10,414 [4]	11,275 [4]	11,957 [4]
Alumina, Al_2O_3 equivalent	do.	2,400	2,800	2,500	2,600	2,700
Metal, primary		624,000 [4]	671,200 [4]	798,800 [4]	861,800 [4]	898,100 [4]
Cadmium metal		436 [4]	466 [4]	477 [4]	489 [4]	407 [4]
Chromium, chromite, gross weight		1,677,924 [4]	2,698,577 [4]	2,210,000 [4]	2,948,944 [4]	3,255,162 [4]
Cobalt metal		250 [4]	270 [4]	255 [4]	545 [4]	1,220 [4]
Copper:						
Mine output, Cu content		32,400 [4]	31,500 [4]	28,500 [4]	29,500 [r, 4]	26,900 [4]
Metal, primary:						
Smelter		293,000 [4]	251,400 [4]	252,000 [4]	252,000 [4]	255,000
Refinery						
Electrolytic, cathode		310,000 [4]	353,700 [4]	375,000 [4]	399,000 [r, 4]	497,000 [4]
Fire refined		18,000	20,000	19,000	20,000	20,000
Total		328,000	374,000	394,000	419,000 [r]	517,000
Gold metal, smelter	kilograms	3,700 [4]	3,800 [4]	3,200 [4]	3,700 [r, 4]	3,200 [4]
Iron and steel:						
Iron ore and concentrate:						
Gross weight	thousand metric tons	79,200 [4]	86,400 [4]	99,100 [4]	120,600 [r, 4]	140,000
Fe content	do.	50,700 [4]	55,300 [4]	63,400 [4]	77,200 [r, 4]	90,000
Metal:						
Pig iron	do.	21,900 [4]	24,315 [4]	24,000	25,000	25,500
Direct-reduced iron	do.	5,590 [4]	5,731 [4]	5,800	5,800	5,900
Ferroalloys:						
Ferrochromium, including charge chrome		267,395 [4]	311,927 [4]	468,677 [4]	527,100 [4]	611,373 [4]
Ferrochromiumsilicon		10,000	10,000	10,000	10,000	10,000
Ferromanganese		165,000	165,000	165,000	170,000	170,000
Ferrosilicon		50,000	52,000	54,000	55,000	56,000
Silicomanganese		150,000	150,000	160,000	160,000	170,000
Other		9,000	9,000	9,000	9,000	9,000
Steel, crude	thousand metric tons	27,291 [4]	28,814 [4]	31,779 [4]	32,000	34,000
Semimanufactures[5]	do.	13,000	13,500	14,000	14,000	15,000
Lead:						
Mine output, Pb content		25,600 [4]	28,600 [4]	34,400 [4]	39,800 [4]	42,000 [4]
Metal, refined:						
Primary		74,400 [4]	74,200 [4]	77,500 [4]	51,000 [r, 4]	43,700 [4]
Secondary		22,000 [4]	35,000 [4]	41,000 [4]	25,000 [4]	25,000 [4]
Total		96,400 [4]	109,200 [4]	118,500 [4]	76,000 [r, 4]	68,700 [4]
Manganese:						
Ore and concentrate, gross weight	thousand metric tons	1,600	1,700	1,650	1,700	1,750
Mn content	do.	600	630	620	630	640
Rare-earth metals, monazite concentrate, gross weight		5,000	5,000	5,000	5,000	5,000
Selenium	kilograms	11,500	11,500	12,000	12,000	13,000
Silver, mine and smelter output	do.	49,500 [4]	52,100 [4]	51,200 [4]	14,500 [r, 4]	31,900 [4]
Titanium concentrates, gross weight:						
Ilmenite		430,000	460,000	500,000	520,000	550,000
Rutile		19,000	18,000	18,000	19,000	19,000
Zinc:						
Mine output, concentrate:						
Gross weight		222,000 [r, 4]	234,300 [4]	294,200 [4]	327,700 [4]	360,000 [4]
Zn content		125,000 [r]	129,000	162,000	184,000	200,000

See footnotes at end of table.

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TABLE 1—Continued
INDIA: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Commodity[3]		2001	2002	2003	2004	2005
METALS—Continued						
Zinc—Continued:						
Metal:						
Primary		207,000 [4]	231,400 [4]	253,900 [4]	238,400 [4]	270,000
Secondary		25,000	24,000	24,000	24,000	23,000
Total		232,000	255,000	278,000	262,000	293,000
Zirconium concentrate, zircon, gross weight		19,000	19,000	20,000	20,000	20,000
INDUSTRIAL MINERALS						
Abrasives, natural, n.e.s.:						
Corundum, natural	kilograms	1,200	1,200	1,150	1,100	1,100
Garnet		125,000	120,000	120,000	125,000	120,000
Jasper		8,000	8,000	8,500	8,500	8,700
Asbestos		21,000	18,000	19,000	18,000	19,000
Barite		850,000	916,000	675,000	723,000	1,000,000
Bromine, elemental		1,500	1,500	1,500	1,500	1,500
Cement, hydraulic	thousand metric tons	105,000	115,000	123,000	125,000	130,000
Chalk		110,000	110,000	115,000	115,000	120,000
Clays:						
Ball clay		370,000	400,000	390,000	400,000	420,000
Diaspore		13,000	12,000	12,000	11,000	11,000
Fireclay		350,000	355,000	360,000	365,000	370,000
Kaolin:						
Salable crude	thousand metric tons	540	540	550	550	560
Processed	do.	170	170	180	180	190
Total	do.	710	710	730	730	750
Other	do.	70	70	75	75	80
Diamond:						
Gem	thousand carats	17	17	16	16	16
Industrial	do.	43	45	44	43	42
Total	do.	60	62	60	59	58
Feldspar		110,000	110,000	150,000	150,000	150,000
Fluorspar:						
Concentrates, metallurgical-grade		13,866 [4]	6,296 [4]	6,300	6,400	6,500
Other fluorspar materials, graded		6,900 [4]	4,188 [4]	4,200	4,300	4,400
Gemstones, excluding diamond:						
Agate, including chalcedony pebble		250	200	200	200	180
Garnet	kilograms	900	700	800	850	850
Graphite[6]		140,000	130,000	110,000	120,000	130,000
Gypsum		2,250,000	2,300,000	2,300,000	2,350,000	2,400,000
Kyanite and related materials:						
Kyanite		5,500	6,000	6,000	6,200	6,800
Sillimanite		13,000	14,000	14,000	14,500	15,000
Lime		910,000	900,000	900,000	900,000	920,000
Magnesite		370,000	380,000	380,000	370,000	380,000
Mica:						
Crude		1,300	1,500	1,600	1,600	1,600
Scrap and waste		1,100	2,000	2,000	2,100	2,100
Total		2,400	3,500	3,600	3,700	3,700
Nitrogen, N content of ammonia	thousand metric tons	10,081 [4]	9,827 [4]	10,048 [4]	10,718 [4]	10,800
Phosphate rock, including apatite		1,200,000	1,250,000	1,175,000 [4]	1,180,000	1,200,000
Pigments, mineral, natural, ocher		355,000	360,000	365,000	360,000	360,000
Pyrites, gross weight		110,000	115,000	115,000	120,000	130,000

See footnotes at end of table.

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TABLE 1—Continued

INDIA: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Commodity[3]		2001	2002	2003	2004	2005
INDUSTRIAL MINERALS—Continued						
Salt:						
Rock salt	thousand metric tons	3	3	3	3	3
Other	do.	14,500	14,500	15,000	15,000	15,500
Total	do.	14,500	14,500	15,000	15,000	15,500
Sand:						
Calcareous	do.	245	250	250	255	260
Silica	do.	1,400	1,400	1,500	1,500	1,600
Other	do.	2,900	2,800	2,900	3,000	3,100
Slate		11,000	10,000	10,500	11,000	12,000
Soda ash		1,500,000	1,500,000	1,500,000	1,500,000	1,500,000
Stone, sand and gravel:						
Calcite		51,000	51,000	52,000	52,000	53,000
Dolomite	thousand metric tons	2,800	2,900	2,900	3,000	3,000
Limestone	do.	110,000	115,000	120,000	125,000	120,000
Quartz and quartzite	do.	270	250	250	260	270
Sulfur, byproduct from fertilizer plants		11,000	11,500	11,500	12,000	13,000
Talc and related materials:						
Pyrophyllite		86,000	85,000	86,000	86,000	85,000
Steatite, soapstone		546,000	550,000	552,000	550,000	545,000
Vermiculite		4,300	4,300	4,400	4,400	4,500
Wollastonite		100,000	105,000	120,000	115,000	120,000
MINERAL FUELS AND RELATED MATERIALS						
Coal:						
Bituminous	thousand metric tons	320,500 [4]	325,000	328,000	330,000	333,000
Liginte	do.	23,000	24,000	25,000	25,000	27,000
Total	do.	343,500 [4]	349,000	353,000	355,000	360,000
Gas, natural:						
Gross	million cubic meters	25,519 [4]	26,000	27,000	28,000	29,000
Marketable	do.	24,000	25,000	25,000	26,000	27,000
Petroleum:						
Crude	thousand 42-gallon barrels	239,292 [4]	240,000	241,000	244,000	248,000
Refinery products:						
Liquefied petroleum gas	do.	42,000	43,000	44,000	44,000	45,000
Gasoline	do.	41,000	42,000	42,000	43,000	43,000
Kerosene and jet fuel	do.	58,000	60,000	59,000	60,000	60,000
Distillate fuel oil	do.	170,000	172,000	171,000	172,000	173,000
Residual fuel oil	do.	67,000	69,000	70,000	71,000	71,000
Other	do.	92,000	94,000	93,000	93,000	94,000
Total	do.	470,000	480,000	479,000	483,000	486,000

[r]Revised.

[1]Estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]Table includes data available through August 2, 2006.

[3]In addition to commodities listed, other gemstones (aquamarine, emerald, ruby, and spinel) and uranium are produced, but output is not reported, and available information is inadequate to make reliable estimates of output levels.

[4]Reported figure.

[5]Excludes production from steel miniplants.

[6]India's marketable production is 10% to 20% of mine production.

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TABLE 2
INDIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity[e]
Alumina	Indian Aluminium Co. Ltd. [Indian interests, 60.4%, and Alcan Aluminium Ltd. (Canada), 39.6%]	Belgaum Refinery, Karnataka	280
Do.	National Aluminium Co. Ltd. (Indian Government, 100%)	Dhamanjodi Refinery, Orissa	1,580
Do.	Bharat Aluminium Co. Ltd. (Indian Government, 49%, and Sterlite Industries Ltd., 51%)	Korba Refinery, Chhattisgarh	200
Do.	Utkal Alumina International Ltd. [Norsk Hydro A/S (Norway), 45%; Alcan Aluminium Ltd. (Canada), 35%; Hindalco Industries Ltd., 20%]	Koraput Refinery, Orissa	1,000 [1]
Do.	Madras Aluminium Co. Ltd. [Alumix SpA (Italian Government), 27%; R. Prabhu and Associates, 24%; Tamil Nadu Industrial Investment Corp., 11%; others, 38%]	Mettur Refinery, Tamil Nadu	60
Do.	Indian Aluminium Co. Ltd. [Indian interests, 60.4%, and Alcan Aluminium Ltd. (Canada), 39.6%]	Muri Refinery, Jharkhand	88
Do.	Hindalco Aluminium Co. Ltd. (Birla Group, 33%; foreign investors, 26%; private Indian investors, 23%; financial institutions, 18%)	Renukoot Refinery, Uttar Pradesh	450
Aluminum	Indian Aluminium Co. Ltd. [Indian interests, 60.4%, and Alcan Aluminium Ltd. (Canada), 39.6%]	Alupuram Smelter, Kerala	20
Do.	National Aluminium Co. Ltd. (Indian Government, 100%)	Angul Smelter, Orissa	345
Do.	Indian Aluminium Co. Ltd. [Indian interests, 60.4%, and Alcan Aluminium Ltd. (Canada), 39.6%]	Belgaum Smelter, Karnataka	70
Do.	do.	Hirakud Smelter, Orissa	30
Do.	Bharat Aluminium Co. Ltd. (Indian Government, 49%, and Sterlite Industries Ltd., 51%)	Korba Smelter, Chhattisgarh	100
Do.	Madras Aluminium Co. Ltd. [Alumix SpA (Italian Government), 27%; R. Prabhu and Associates, 24%; Tamil Nadu Industrial Investment Corp., 11%; others, 38%]	Mettur Smelter, Tamil Nadu	25
Do.	Hindalco Aluminium Co. Ltd. (Birla Group, 33%; foreign investors, 26%; private Indian investors, 23%; financial institutions, 18%)	Renukoot Smelter, Uttar Pradesh	275
Barite	Andhra Pradesh Mineral Development Corp. Ltd. (Andhra Pradesh State government, 100%)	Cuddapah District mines, Andhra Pradesh	350
Do.	Associated Mineral Corp.	do.	75
Do.	Pragathi Minerals	do.	50
Do.	Shri C.M. Ram nath Reddy	do.	75
Do.	Vijaylaxmi Minerals Trading Co.	do.	50
Bauxite	Bharat Aluminium Co. Ltd. (Indian Government, 49%, and Sterlite Industries Ltd., 51%)	Amarkantak Mine, Madhya Pradesh	200
Do.	Indian Aluminium Co. Ltd. [Indian interests, 60.4%, and Alcan Aluminium Ltd. (Canada), 39.6%]	Kolhapur district mines, Maharashtra	600
Do.	Gujarat Mineral Development Corp. (Gujarat State government, 100%)	Kutch and Saurashtra Mines, Gujarat	500
Do.	Hindalco Aluminium Co. Ltd. (Birla Group, 33%; foreign investors, 26%; private Indian investors, 23%; financial institutions, 18%)	Lohardarga district mines, Jharkhand	750
Do.	Indian Aluminium Co. Ltd. [Indian interests, 60.4%, and Alcan Aluminium Ltd. (Canada), 39.6%]	do.	200
Do.	National Aluminium Co. Ltd. (Indian Government, 100%)	Panchpatmali Hills, Koraput district mines, Orissa	4,800
Do.	Minerals & Minerals Ltd. (Indian Government, 100%)	Richuguta, Palamau district mines, Jharkhand	200
Borax	Borax Morarji Ltd.	Ambernath, Maharashtra	17
Cement	Larsen and Toubro Ltd.	Awarpur Plant, Maharashtra	2,300
Do.	Century Cement (Century Textiles and Industries Ltd., a subsidiary of the Birla Group, 100%)	Baikunth Plant, Madhya Pradesh	1,120

See footnotes at end of table.

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TABLE 2—Continued
INDIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity[e]
Cement—Continued:		Coromandel Fertilizers Ltd. [Chevron Chemical Co. (United States), 23.55%; International Minerals and Chemical Co., 20.89%; Parry and Co., 10.64%; E.I.D. Parry (India) Ltd., 6.65%; others, 38.27%]	Chilamkur Plant, Andhra Pradesh	1,000
Do.		The Associated Cement Cos. Ltd. (Indian Government, 34.86%, and private shareholders, 65.14%)	Gagal Plant, Himachal Pradesh	1,830
Do.		Raymond Cement Works (a division of Raymond Woolen Mills Ltd., JK Singhania, principal shareholder)	Gopalnagar Plant, Madhya Pradesh	1,250
Do.		Narmada Cement Co. Ltd. (Chowgule and Co. Ltd., 34%; Gujarat State Government, 17.33%; others, 48.67%)	Jafrabad Plant, Gujarat	1,000
Do.		Rajashree Cement (a division of Indian Rayon and Industries Ltd., 100%)	Khor Plant, Karnataka	1,020
Do.		The Associated Cement Cos. Ltd. (Indian Government, 34.86%, and private shareholders, 65.14%)	Kymore Plant, Madhya Pradesh	1,500
Do.		Mangalam Cement Ltd.	Morak Plant, Rajasthan	1,000
Do.		Mysore Cements Ltd. (Government institutions and banks, 41.13%; Corporate Trust Holdings, 21.70%; others, 37.17%)	Narasingarh Plant, Madhya Pradesh	1,089
Do.		Cement Corp. of India Ltd. (Indian Government, 100%)	Nayagaon Plant, Madhya Pradesh	1,330
Do.		JK Cement Works (a division of JK Synthetics Ltd., 100%)	Nimbahera Plant, Rajasthan	1,462
Do.		The India Cement Co. Ltd. (Indian Government, 26%; Life Insurance Corp. of India, 24%; others, 50%)	Sankarnagar Plant, Tamil Nadu	1,000
Do.		Maihar Cement (Century Textiles and Industries Ltd., a subsidiary of the Birla Group, 100%)	Satna Plant, Madhya Pradesh	1,800
Do.		Shree Digvijay Cement Co. Ltd.	Shreeniwas Plant, Maharashtra	1,060
Do.		Lakshmi Cement (a division of Straw Products Ltd., JK Singhania, principal shareholder)	Sirohi Plant, Rajasthan	1,400
Do.		Manikgarth Cement (Century Textiles and Industries Ltd., a subsidiary of the Birla Group, 100%)	Tehsil Rajura Plant, Maharashtra	1,000
Do.		Vasavadatta Cement (Kesoram Industries Ltd., 100%)	Vasavadatta Plant, Karnataka	1,000
Do.		Vikram Cement (Grasim Industries Ltd., a subsidiary of the Birla Group, 100%)	Vikram Plant, Madhya Pradesh	1,000
Do.		Raasi Cement Ltd. (Andhra Pradesh government, 50%, and Development Co. Ltd., 50%)	Vishnupuram Plant, Andhra Pradesh	1,000
Do.		The Associated Cement Cos. Ltd. (Indian Government, 34.86%, and private shareholders, 65.14%)	Wadi Plant, Karnataka	2,180
Chromite		Ferro Alloys Corp. Ltd.	Cuttack district, Orissa	120
Do.		Orissa Mining Corp. Ltd. (Orissa Industries Ltd., 100%)	do.	300
Do.		Tata Iron and Steel Co. Ltd.	do.	100
Do.		Ferro Alloys Corp. Ltd.	Dhenkanal district, Orissa	75
Do.		Orissa Mining Corp. Ltd. (Orissa Industries Ltd., 100%)	do.	200
Do.		Mysore Minerals Ltd.	Hassan district, Karnataka	125
Do.		Ferro Alloys Corp. Ltd.	Kendujhar district, Orissa	75
Do.		Orissa Mining Corp. Ltd. (Orissa Industries Ltd., 100%)	do.	100
Do.		Ferro Alloys Corp. Ltd.	Khammam District, Andhra Pradesh	100
Coal, bituminous	million metric tons	Bharat Coking Coal Ltd. (a subsidiary of Coal India Ltd., Indian Government, 100%)	Bihar and West Bengal	26
Do.	do.	Central Coalfields Ltd. (a subsidiary of Coal India Ltd., Indian Government, 100%)	Bihar	27
Do.	do.	Eastern Coalfields Ltd. (a subsidiary of Coal India Ltd., Indian Government, 100%)	Bihar and West Bengal	21
Do.	do.	Mahanadi Coalfields Ltd. (a subsidiary of Coal India Ltd., Indian Government, 100%)	Orissa	21
Do.	do.	North Eastern Coalfields Ltd. (a subsidiary of Coal India Ltd., Indian Government, 100%)	Assam	640

See footnotes at end of table.

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TABLE 2—Continued
INDIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity[e]
Coal, bituminous— Continued:	million metric tons	Northern Coalfields Ltd. (a subsidiary of Coal India Ltd., Indian Government, 100%)	Madhya Pradesh and Uttar Pradesh	24
Do.	do.	Singareni Collieries Co. Ltd. (Andhra Pradesh State government, 50%, and Indian Government, 50%)	Andhra Pradesh	18
Do.	do.	South Eastern Coalfields Ltd. (a subsidiary of Coal India Ltd., Indian Government, 100%)	Madhya Pradesh	36
Do.	do.	Western Coalfields Ltd. (a subsidiary of Coal India Ltd., Indian Government, 100%)	Madhya Pradesh and Maharashtra	18
Coal, lignite	do.	Neyveli Lignite Corp. Ltd. (Indian Government, 100%)	Tamil Nadu	17
Copper, mine		Hindustan Copper Co. Ltd. (Indian Government, 100%)	Indian Copper Complex mines, Ghatsila District, Bihar	31
Do.		do.	Khetri Copper Complex mines, Khetrinagar Rajasthan	15
Do.		do.	Malanjkhand Copper Complex mines, Balaghar district, Madhya Pradesh	22
Copper, metal		Birla Copper	Birla Copper Complex smelter, Dahej, Gujarat	150
Do.		Hindustan Copper Co. Ltd. (Indian Government, 100%)	Indian Copper Complex smelter-refinery, Ghatsila district, Bihar	20
Do.		do.	Khetri Copper Complex smelter-refinery, Khetrinagar district, Rajasthan	45
Do.		Sterlite Industries Ltd.	Tuticorin Smelter, Tamil Nadu	180
Do.		do.	Silvassa Refinery, Gujarat	180
Diamond	carats	Indian Government	Mahjgawan Mine	25,000
Gold	kilograms	Hutti Gold Mines Co.	Hutti Mine, Karnataka	3,000
Ilmenite-rutile ore		Kerala Minerals and Metals Ltd. (Kerala State government, 100%)	Chavara, Kerala	100
Do.		Indian Rare Earths Ltd. (Indian Government, 100%)	do.	200
Do.		do.	Ganjam, Orissa	220
Do.		do.	Manavalakurichi, Tamil Nadu	65
Do.		VV Minerals Ltd.	Kanyakumari, Tamil Nadu	130
Iron and steel, crude steel		Visvesvaraya Iron and Steel Ltd. (Karnataka State, 60%, and Steel Authority of India Ltd., Indian Government, 40%)	Bhadravati steel plant, Karnataka	180
Do.		Steel Authority of India Ltd. (Indian Government, 100%)	Bhilai steel plant, Madhya Pradesh	4,930
Do.		do.	Bokaro steel plant, Bihar	4,000
Do.		Indian Iron and Steel Co. Ltd. (wholly owned subsidiary of Steel Authority of India Ltd., Indian Government, 100%)	Burnpur steel plant, West Bengal	1,500
Do.		Steel Authority of India Ltd. (Indian Government, 100%)	Durgapur steel plant, West Bengal	1,600
Do.		Tata Iron and Steel Co. Ltd.	Jamshedpur steel plant, Bihar	4,000
Do.		Steel Authority of India Ltd. (Indian Government, 100%)	Rourkela steel plant, Orissa	1,800
Do.		Rashtriya Ispat Nigam Ltd.	Visakhapatnam steel plant, Andhra Pradesh	3,200
Do.		JSW Steel Co. Ltd.	Vijayanagar, Karnataka	2,500
Do.		Ministeel plants (privately owned)	About 180 plants located throughout India	4,700
Iron ore		National Mineral Development Corp. Ltd. (Indian Government, 100%)	Bailadila, Madhya Pradesh	9,000
Do.		Steel Authority of India Ltd. (Indian Government, 100%)	Bastar and Durg district, Madhya Pradesh	7,000
Do.		Kudremukh Iron Ore Co. Ltd. (Indian Government, 100%)	Kudremukh, Chikmagalur district, Karnataka	10,300
Do.		National Mineral Development Corp. Ltd. (Indian Government, 100%)	Donimalai, Karnataka	9,000
Do.		Chowgule and Co. Ltd.	Goa	2,500

See footnotes at end of table.

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TABLE 2—Continued
INDIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity[e]
Iron ore—Continued:	Dempo Mining Corp. Ltd.	Goa	2,500
Do.	V.M. Salgaocar & Bros. Pvt. Ltd.	do.	2,500
Do.	Sesa Goa Ltd.	Codli and Sonshi, Goa	NA
Do.	Steel Authority of India Ltd. (Indian Government, 100%)	Kendujhar district, Orissa	3,000
Do.	Tata Iron and Steel Co. Ltd.	do.	2,000
Do.	Indian Iron and Steel Co. Ltd. (wholly owned subsidiary of Steel Authority of India Ltd., Indian Government, 100%)	Singhbhum district, Bihar	2,500
Do.	Steel Authority of India Ltd. (Indian Government, 100%)	do.	3,500
Do.	Tata Iron and Steel Co. Ltd.	do.	3,500
Kyanite	Associated Mining Co.	Bhandara district, Maharashtra	10
Do.	Maharashtra Mineral Corp. Ltd.	do.	10
Do.	Bihar State Mineral Development Corp. Ltd. (Bihar State government, 100%)	Singhbhum district, Bihar	10
Do.	Hindustan Copper Co. Ltd. (Indian Government, 100%)	do.	22
Lead:			
Primary	Hindustan Zinc Ltd. (Indian Government, 100%)	Chanderiya Smelter, Rajasthan	35
Do.	do.	Tundoo Smelter, Bihar	8
Secondary	Indian Lead Co.	Thane Refinery, Mumbai, Maharashtra	25
Do.	do.	Wada, Mumbai, Maharashtra	40
Lead ore	Hindustan Zinc Ltd. (Indian Government, 100%)	Agnigundala Mine, Andhra Pradesh	72
Do.	do.	Sargipalli Mine, Orissa	150
Lead-zinc ore	do.	Rampura-Agucha Mine, Rajasthan	1,300
Do.[r]	do.	Zawar mine group, Rajasthan	1,200
Magnesite	Burn Standard Co. Ltd. (Indian Government, 100%)	Salem, Tamil Nadu	150
Do.	Dalmia Magnesite Corp.	do.	150
Do.	Tamil Nadu Magnesite Ltd. (Tamil Nadu State government, 100%)	do.	150
Manganese ore[2]	Manganese Ore India Ltd. (Indian Government, 100%)	Adilabad, Andhra Pradesh	NA
Do.	Falechand Marsingdas	Andhra Pradesh	NA
Do.	Manganese Ore India Ltd. (Indian Government, 100%)	Balaghat, Madhya Pradesh	NA
Do.	J.A. Trivedi Bros.	do.	NA
Do.	Sandur Manganese and Iron Ores Ltd.	Bellary, Karnataka	NA
Do.	Manganese Ore India Ltd. (Indian Government, 100%)	Bhandara, Maharashtra	NA
Do.	Eastern Mining Co.	North Kanara, Karnataka	NA
Do.	Mysore Minerals Ltd.	do.	NA
Do.	Manganese Ore India Ltd. (Indian Government, 100%)	Keonjhar, Orissa	NA
Do.	Mangilah, Rungta (Pvt.) Ltd.	do.	NA
Do.	Orissa Mining Corp. Ltd.	do.	NA
Do.	Rungta Mines (Pvt.) Ltd.	do.	NA
Do.	Serajuddin & Co.	do.	NA
Do.	S. Lall & Co.	do.	NA
Do.	Tata Iron and Steel Co. Ltd.	do.	NA
Do.	Orissa Mineral Development Co. Ltd.	Koraput, Orissa	NA
Do.	Orissa Mining Corp. Ltd.	do.	NA
Do.	Mysore Minerals Ltd.	Shimoga, Karnataka	NA
Do.	Aryan Mining & Trading Corp.	Sundargarh, Orissa	NA
Do.	Orissa Manganese & Minerals (Pvt.) Ltd.	do.	NA
Do.	Tata Iron and Steel Co. Ltd.	do.	NA
Do.	R.B.S. Shreeram Durga Prasad and Falechand Marsingdas	Vizianagaram, Andhra Pradesh	NA
Mica metric tons	Micafab India Pvt. Ltd.	Sydapuram Mandal, Andhra Pradesh	4,500
Do. do.	Premier Mica Co.	Rjupalem, Andhra Pradesh	200

See footnotes at end of table.

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TABLE 2—Continued
INDIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity[e]
Petroleum, refined products	thousand 42-gallon barrels per day	Cochin Refineries Ltd. (a subsidiary of Oil and Natural Gas Corp., Indian Government, 55%, and private interests, 45%)	Ambalamugal Refinery, Kerala	93,000
Do.	do.	Indian Oil Corp. (a subsidiary of Oil and Natural Gas Corp., Indian Government, 91%, and private interests, 9%)	Barauni Refinery, Bihar	66,000
Do.	do.	Bongaigaon Refinery and Petrochemicals Ltd. (a subsidiary of Oil and Natural Gas Corp., Indian Government, 100%)	Bongaigaon Refinery, Assam	27,000
Do.	do.	Indian Oil Corp. (a subsidiary of Oil and Natural Gas Corp., Indian Government, 91%, and private interests, 9%)	Digboi Refinery, Assam	12,000
Do.	do.	do.	Guwahati Refinery, Assam	20,000
Do.	do.	do.	Haldai Refinery, West Bengal	61,000
Do.	do.	do.	Koyali Refinery, Gujarat	185,000
Do.	do.	Madras Refineries Ltd. (a subsidiary of Oil and Natural Gas Corp., Indian Government, 52%, and private interests, 48%)	Madras Refinery, Tamil Nadu	131,000
Do.	do.	Bharat Petroleum Corp. Ltd. (a subsidiary of Oil and Natural Gas Corp., Indian Government, 67%, and private interests, 33%)	Mahul Refinery, Mumbai, Maharashtra	135,000
Do.	do.	Industan Petroleum Corp. Ltd. (a subsidiary of Oil and Natural Gas Corp., Indian Government, 51%, and private interests, 49%)	do.	110,000
Do.	do.	do.	Visakhapatnam Refinery, Andhra Pradesh	90,000
Do.	do.	Indian Oil Corp. (a subsidiary of Oil and Natural Gas Corp., Indian Government, 91%, and private interests, 9%)	Mathura Refinery, Uttar Pradesh	156,000
Do.	do.	do.	Panipat Refinery, Haryana	120,000
Phosphate rock[1]		Rajasthan State Mineral Development Corp. Ltd. (Rajasthan State government, 100%)	Badgaon, Dakankotra, Kanpur, Kharbaria-ka-Guda, and Sallopat Mines, Rajasthan	NA
Do.		Pyrites Phosphates and Chemicals Ltd.	Durmala and Maldeota underground mines, Uttar Pradesh	NA
Do.		Madhya Pradesh State Mining Corp. Ltd. (Madhya Pradesh State government, 100%)	Hirapur and Khatamba Mines, Madhya Pradesh	NA
Do.		Rajasthan State Mines and Minerals Ltd. (Rajasthan State government, 100%)	Jhamarkotra Mine, Rajasthan	NA
Do.		Hindustan Zinc Ltd. (Indian Government, 100%)	Maton Mine, Rajasthan	NA
Zinc		Binani Zinc Ltd.	Binanipuram Smelter, Kerala	38
Do.		Hindustan Zinc Ltd. (Indian Government, 100%)	Chanderiya Smelter, Rajasthan	100
Do.		do.	Debari Smelter, Rajasthan	78
Do.		do.	Visakhapatnam (Vizag) Smelter, Andhra Pradesh	54

[e]Estimated. NA Not available.
[1]Scheduled for startup in 2005.
[2]Capacity of clusters of surface mines varies extremely, depending on demand. Estimated total capacity is 1.5 million metric tons per year.
[3]Estimated total phosphate rock capacity is 800,000 metric tons per year.

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THE MINERAL INDUSTRY OF INDONESIA

By Pui-Kwan Tse

The territory of Republic of Indonesia, which includes more than 17,000 islands, of which 1,000 are permanently settled, is located along the equator in the Pacific Ocean. Indonesia is the third most populous country in the Asia and the Pacific region behind China and India. Indonesia is divided into 32 Provinces, of which 3 are special provincial territories—Nangroe Aceh Darussalam, Yogyakarta Special Territory, and Jakarta Metropolitan Special Territory. Each Province is divided into regencies and cities. A regency usually includes a capital city and the surrounding area, as well as a great area of hinterlands. A regency and a city are at the same level in the governmental hierarchy. During the past decade, one of the many challenges facing Indonesia was the need to distribute wealth, especially from the mining sector, while retaining the participation of foreign investors in the mining sector. In 1999, the House of Representative passed two laws—law No. 22/1999, Regional Political Autonomy, and law No. 25/1999, Fiscal Decentralization—which went into effect on January 1, 2001. Mining companies were confused about these laws, which were contradicted by law No. 11/1967 on general mining. Without any clear mining policy, many foreign investors were concerned about the legal and political stability in the country and had deferred new investments (Indonesia's Investment Coordinating Board, 2005§[1]).

In 2005, the Indonesian economy showed remarkable growth. Owing to domestic demand, the real gross domestic product (GDP) growth rate increased by 5.6%, which was higher than the growth rate of 5.1% in 2004. Supported by high investment in sectors other than the mineral sector, economic growth increased by 6.1% in the first quarter in 2005 and then declined to 5.1% in the fourth quarter because of sluggish consumption and falling investment in the second half of the year. Excluding investment in finance, gas, and oil, foreign direct investment nearly doubled to $8.9 billion in 2005 from $4.6 billion in 2004, which was far from the peak of $39.7 billion in 1995. Domestic investment increased to $3.2 billion. In 2005, the Government approved 61 foreign investment mining projects with a total value of $775.9 million compared with 21 projects with a total value of $67.8 million in 2004. All sectors experienced positive growth. The largest contribution to economic growth was from trade. The mining and quarrying sector contributed only 0.1% of total growth (Bank Indonesia, 2006, p. 7).

Government Policies and Programs

Indonesia's principal mineral resources are coal, copper, gold, nickel, oil, and tin. Mining provides significant local employment directly at the mine site and indirectly through the supply of goods and services from Indonesian sources. A significant part of Indonesia remains unexplored; some of these land areas are the most prospective for mineral development in the Asia and the Pacific region. The mining sector could have the potential to become a much larger contributor to the country's economy and to regional development. The Government announced an "Investment Climate Improvement Package" containing 85 regulatory and institutional reforms to improve the investment climate; it was expected to take effect in 2006. The package included improving investment licensing and permitting procedures and synchronizing regulations and procedures between the Central Government and local administration. The Government planned various incentives for investment projects in specific sectors. To improve transparency in taxation, the Government would review the value-added tax on particular commodities to promote exports. The Government intended to simplify importing procedures on capital equipment and goods for investment purposes. Labor regulations were expected to be amended to define the relationship between employers and employees (Jakarta Post, The, 2006c§).

The Government planned to reform the country's tax regime by the revision of several tax bills, which included law No. 16/2000 on general taxation arrangements and procedures, law No. 17/2000 on income tax, and law No. 18/2000 on value-added tax on goods and services and luxury sales tax. The draft revisions of these bills were submitted to the House of Representatives for approval; however, the business community, which included foreign investors, expressed concerns about several new provisions that granted more authority to tax officials. Initially, these bills were intended to improve the country's fiscal conditions and to provide a more-friendly tax regime to attract foreign investors. The business community urged the Government to reverse these tax bills so that the tax collecting office would have sufficient powers to fulfill its tax collection duties but not abuse its power. The Government hoped the reform tax bills could be passed in 2006 and would be implemented in 2007 (Jakarta Post, The, 2006c§).

After more than 5 years of discussion, the draft of the new mining law that will replace the general mining law No. 11/1967 had not been completed. Replacement of law No. 11/1967 was considered to be necessary because the old law was not compatible with current conditions in the mining sector, which had changed considerably during the past several years. The new draft bill would be called the Mineral and Coal Mining Law. The fundamental changes in the new draft bill are as follows: the term contract of work (COW) would be replaced by mining licenses—mining business licenses, people's mining licenses, and mining assignments. The draft bill treats foreign and domestic investors the same, which is quite different from law No. 11/1967. The draft bill would strengthen such environmental concerns as mining safety, waste disposal, and postmining land reclamation. The draft bill was submitted to the House of Representatives for consideration in May 2005 (Petrominer, 2006g).

[1]References that include a section mark (§) are found in the Internet References Cited section.

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To ensure a sufficient supply of coal in the domestic market, the Government imposed a 5% tax on coal exports starting on December 25, 2005. Indonesia exported about 70% of its coal output. The Government set the base price at $30 per metric ton on January 5, 2006, and the base price was to be reviewed on the 23rd of every month. The Indonesian Coal Mining Association indicated that the coal export tax levies would raise export prices and reduce the country's competitiveness for coal against such countries as Australia, China, South Africa, and Vietnam (Petrominer, 2005e; Jakarta Post, The, 2006b§).

The Indonesian Government issued three energy policies—Inpres No. 1/2006 and No. 2/2006 and regulation No. 5/2006—as the basis for future national energy regulations and laws. The policy set a target for reducing the country's dependence on oil as fuel. Oil used in the energy sector was targeted to be reduced to 20% in 2025 from 55% in 2005. Coal and natural gas use would increase to 33% each in 2025 from 15.7% and 23%, respectively, in 2005. Other energy sources, such as biofuel, geothermal, renewable energy, and liquefied coal, also would be used. The Ministry of Energy and Mineral Resources was responsible for drafting the plan and coordinating the implementation of the plan (Petrominer, 2006b, f).

Trade

In 2005, Indonesia's exports increased by 19.5% to $85.7 billion, and imports increased by 23.7% to $57.5 billion. Oil and gas exports accounted for 22.5% ($19.3 billion) of the export total. Indonesia increased its oil and gas imports to $17.4 billion, or 30.2% of the import total. Mining products accounted for 10.5% of the export total. In terms of value, coal, copper, and tin were the leading exported mineral commodities. Japan was the leading destination for Indonesian non-oil-and-gas products followed by the United States, Singapore, and China. In descending order, Japan, Hong Kong, India, the Republic of Korea, Malaysia, and Taiwan were major markets for Indonesian coal. The main sources for Indonesian imports of non-oil-and-gas products were China, Japan, Singapore, and the United States (Central Bureau of Statistics, 2006).

Commodity Review

Metals

Aluminum.—PT Indonesia Asahan Aluminium (Inalum), which was the only aluminum smelter in Southeast Asia, planned to increase its output to 252,000 metric tons (t) in 2005. During the past several years, low water levels at Lake Toba in northern Sumatra, which was the main source of water for Inalum's hydroelectric powerplant, restricted power supply to the smelter. Owing to the shortage of electricity, the production of aluminum was well below its designed output capacity of 250,000 t from its 510 pots using185-kiloampere prebaked cell. The company planned to produce 244,000 t of aluminum ingot in 2006. The smelter was owned by the 12-company Japanese consortium Nippon Asahan Aluminium Co. Ltd. (59%) and the Government (41%). Inalum exported 60% of its output to China and Japan; the rest went to the domestic market. Alumina was imported from Australia. The Government planned to take over the Talang and the Sigura-gura hydropower electricity generation projects to meet electricity demand in North Sumatra, which was run by Japanese investors associated with Inalum (Antara News, 2006§).

Indonesian bauxite producer PT Aneka Tambang Tbk (PT Antam) completed all mandated studies for the Tayan chemical-grade alumina project in Tayan, West Kalimantan Province. The total investment of the project was estimated to be $220 million. PT Antam signed a joint-venture agreement with Japan's Marubeni Corp. and Showa Denko K.K. (SDK) and Singapore's Strait Trading Amalgamated Resources Private Limited for the chemical-grade alumina project. PT Antam held a 49% share in the project and its partners held the remaining 51%. PT Antam was to supply bauxite to the Tayan project. SDK would provide the technology and technical assistance to produce chemical-grade alumina, and Marubeni would manage the project. The refinery was designed to produce 300,000 metric tons per year (t/yr) of chemical-grade alumina containing 50% (by weight) of alumina from 800,000 t to 1.13 million metric tons (Mt) of bauxite. The product was to be sold through offtake agreements between the project sponsors. The partners would establish a joint-venture company to oversee the Tayan project, which would start operations in 2009. In 2005, PT Antam also signed a memorandum of understanding with Aluminum Corp. of China to build a metallurgical-grade alumina plant in Indonesia (PT Antam Tbk, 2006a; Miningindo.com, 2005a§).

Copper.—After the 2003 landslide at the southern part of PT Freeport Indonesia's Grasberg Mine, the company decided to suspend all mining operations until the second quarter of 2004. In 2004, mining operations were limited to the company's deep ore zone underground mine and extraction of low-grade ore from the open pit. In 2005, mining operations returned to normal and the average ore output increased to 216,200 metric tons per day (t/d), which was higher than the output of 185,100 t/d in 2004; copper ore grades averaged 1.13% compared with 0.87% for 2004. The average grades of silver and gold were 4.88 grams per metric ton (g/t) and 1.65 g/t, respectively. The increase in mining output and higher ore grades in Grasberg Mine reflected an increase in the country's copper, gold, and silver output because PT Freeport was Indonesia's leading copper, gold, and silver producer. PT Freeport and PT Newmont Nusa Tenggara (NNT) accounted for about 100% of Indonesia's copper production and 70% of its gold output. Owing to safety and security issues and regulatory uncertainty in the forest areas, mineral exploration activities in the Block B area in Papua were suspended (Freeport-McMoRan Copper and Gold Inc., 2006, p. 26).

In 2004, Freeport McMoRan Copper and Gold Inc. (Freeport) of the United States informed the Indonesian Government that the company planned to merge Freeport and PT Indocopper Investama. Freeport and Indocopper held 81.28% and 9.36%, respectively, of Freeport shares; the remaining shares were owned by the Indonesian Government. In July 2004, the Indonesian Government requested Freeport to sell Indocopper's 9.36% share to an Indonesian company. The Indonesian Government asked PT Antam to acquire Indocopper's share in Freeport. PT Antam appointed the Hong Kong and Shanghai

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Bank as financial adviser to evaluate the potential investment in Freeport in 2005. Owing to the lack of support from the Government and the high market value, PT Antam decided to postpone the plan to acquire the share in Freeport indefinitely (PT Antam Tbk, 2006b, p. 63).

The Government sent an environmental investigation team to the mining and processing areas of Freeport's Grasberg Mine because of the company's failure to maintain water quality in the Otomina River. Million of tons of hazardous waste from the tailings had reached the surface of the Arafuru coast. Based on the results of monitoring, which included environmental impact analysis and air and water pollution control by the investigation team, the Environment Ministry concluded that Freeport had violated the prevailing environmental provisions in Indonesia. The Indonesian Government ordered Freeport to immediately improve the managerial system of the acidic water waste and the environmental impact of the deposition of tailings in the Modified Ajkwa Deposition Area. Some nongovernment organizations urged the Government to shut down Freeport's operation in Papua (Petrominer, 2006e; Miningindo.com, 2006a§, c§).

Owing to a partial collapse of the pit wall, NNT was forced to mine lower copper ore grades at its copper- and gold-producing mine, Batu Hijau, which is located on Sumbawa Island, West Nusa Tenggara Province. Copper output decreased by 18% to 266,074 t. As a result of higher fuel and labor costs, operational costs increased; however, Batu Hijau Mine remained Newmont's lowest-cost operating mine. Because of geotechnical instability of the operation's east pit wall, mine production was expected to decrease in the next several years. The company applied to the Ministry of Environment (MOE) for a 3-year extension of its submarine sea-tailing permit, which will expire in May 2005. The Government granted a 2-year extension permit, and the tailing disposed volume was reduced to 50.4 Mt from the previous 58.4 Mt. NNT discovered a new copper deposit at the Elang Dodo field in East Sumbawa, East Nusa Tenggara Province. The deposit's reserves could exceed those of Freeport's Grasberg deposit (Newmont Mining Corporation, 2006).

Gold and Silver.—PT Newmont Minahasa Raya's (NMR) gold mining operation ceased in October 2001. Since then, operation activity has been limited to process ore stocks. In 2004, villagers of Minahasa Regency complained that NMR had polluted Buyat Bay. Water and fish that were allegedly contaminated by NMR's tailings, which were disposed of in Buyat Bay, were being blamed for causing villagers to get sick. After long and exhaustive tests, the Government's technical team concluded that the arsenic and mercury contents at Buyat Bay were higher than standard levels, and that the arsenic content in the drinking water and in fish was a health risk to the people of Buyat Bay. The Indonesian Mining Association and the NMR insisted that, according to laboratory results from Japan's Minamata Institute and the World Health Organization, metal contents were within the safety standards. NMR and the residents at Buyat Bay signed an out-of-court compensation settlement in December 2004. The MOE continued to pursue legal action against NMR in 2005. The District Court Judge ordered the MOE and NMR to renegotiate an out-of-court settlement, and they reached agreement on a $30 million "good will" settlement that would be paid out during a 10-year period. The Government, however, retained the legal right to prosecute the executives in charge of NMR (Jakarta Post, The, 2006d§).

The Government granted PT Newmont Horas Nauli's (a subsidiary of PT Newmont Indonesia) request for an extension of the exploration permit in the regency of South Tapanuli in North Sumatra until May 26, 2006. The exploration permit was issued to PT Danau Toba Mining (a subsidiary of Normady Company) in 1997 under the sixth generation of COW; Newmont acquired the exploration permit from Normady in 2001. Owing to ownership transfer problems, PT Newmont Horas Nauli had actually carried out the exploration in the area for 3 years instead of 5 years (3 years plus 2 extended exploration permits of 1 year each). The exploration project was better known as "Newmont Martabe Project," and about 1,033 t of silver and 96 t of gold were discovered in two locations: Baskara and Tor Sipalpal (or Purnama). Newmont considered that the resource was not economical enough to continue further development and decided to transfer the property to the Government. PT Antam was interested in acquiring the property from the Government (Petrominer, 2006a; Antara News, 2005§; Miningindo.com, 2005d§, 2006b§).

PT Avocet Bolaang Mongondow [a joint venture of Avocet Mining of the United Kingdom (80%) and PT Lebong Tandia of Indonesia (20%)] commenced its gold mine production in October 2004. The North Lanut gold mine is located in the center of North Sulawesi Province in the District of Bolaang Mongondow. The mine is located within the area defined by the COW, and included exploration and mining rights of approximately 50,000 hectares (ha). The open pit mine had a designed output capacity of more than 1.6 t/yr of gold. Owing to poor equipment availability and extremely wet conditions, production fell behind expectation initially but the mine was expected to be able to operate at full capacity by upgrading the waste dump retention wall and increasing the mine water discharge capacity in 2006. The operating cost was $200 per ounce of gold. The company continued exploring around the surrounding North Lanut area. Avocet also explored for gold in the Provinces of Papua and South Sulawesi (Avocet Mining PLC, 2006, p. 16-20).

Illegal gold mining caused severe environmental damage to rivers on the islands of Kalimantan and Sulawesi. The 250-kilometer (km) Kalhayan River hosted 500 dredging machines from Palangkaraya City to Gunung Mas Regency in Kalimantan. The Provincial Government of Central Kalimantan recorded more than 6,500 dredges in 2003. Four or five persons operated each dredge. Most illegal miners used mercury to extract gold, and mercury contamination was noticeable in the illegal mining areas. In March 2004, fire broke out at the illegal mining tunnels adjacent to PT Antam's underground gold mine operation at Pongkor, West Java. PT Antam planned to produce 3 t of gold and 25 t of silver in 2005; owing to the brittle rock structure of tunnel walls within the mine, however, the company was forced to mine lower-grade ore. As a result, output of gold and silver decreased to 2.9 t and 24.6 t in 2005 from 3.7 t and 27.6 t in 2004, respectively. PT Antam planned to redesign the mine plan and hoped to increase output in the future. The company planned to produce 2.3 t of gold in 2006 (Petrominer, 2005d, 2006h).

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Iron and Steel.—Owing to depleted resources, PT Antam ceased its iron sand mining activities at Cilacap, Central Java, in 2005. Iron sand was produced from its two small-scaled iron sand mines at Kutoarjo and Lumajang. PT Antam assigned these two operations to its subsidiary, PT Antam Resourcindo, and planned to sell them. The company allocated $200,000 for the mine closure and post mining activities at Cilacap (PT Antam Tbk, 2006b, p. 63).

During the past 2 years, Indonesian steel production increased to more than 3 million metric tons per year (Mt/yr) but the country consumed more than 4 Mt/yr. Indonesia's only integrated steel producer, state-owned PT Krakatau Steel, planned to increase its steel output to 3.5 Mt/yr by 2008 to meet increasing domestic demand for hot-rolled coil, plate, and wire. The Government suggested that a new steel plant be built in South Kalimantan Province because the Province was rich in coal and iron ore. The cost of the new plant was estimated to be about $500 million. The company planned to raise funds either by selling its assets or through an initial public offering. Krakatau signed a memorandum of understanding with Chinese companies Chuan Wei Group Co. Ltd. and Sichuan Chuan Wei Co. Ltd., and PT Sumbergas Sakti Prima of Indonesia to mine iron ore and to build a pelletizing plant in Kalimantan; the plant would have an output capacity of 4.3 Mt/yr. Krakatau had the capacity to produce 1.9 Mt/yr of slab and 500,000 t/yr of billet from its direct-reduced iron and electric arc furnace processes. The company imported its iron ore pellet mainly from, in order of amount imported, Brazil, Chile, and Bahrain and considered sourcing pellets from Australia in its expansion plan. Krakatau sold 75% of its steel output to local customers (Coordinating Ministry for Economic Affairs, 2006).

Blue Scope Steel of Australia planned to invest $105 million to build a steel plant in Cilegon, West Java. The plant was designed to produce 90,000 t/yr of metal-coated steel and 55,000 t/yr of color-coated steel. The plant was scheduled to begin operating in 2008 (Jakarta Post, The, 2006f§).

Nickel.—Owing to increased demand, the supply of nickel continued to tighten in 2005 as China and the Republic of Korea expanded their stainless steel output capacities; as a result, the price of nickel in the world market remained high at yearend. Despite an increase in production costs, the net income of PT Antam and PT International Nickel Indonesia Tbk (PT Inco) increased in 2005. About 20% to 25% of PT Antam's nickel ore output was used as feedstock to produce ferronickel, which contained about 80% iron and 20% nickel; the remainder was exported. PT Antam exported its saprolite nickel ore to Japan and limonite nickel ore to Australia. In March and September 2005, PT Antam shut down its FeNi II smelter for a routine overhaul. As a result, production of nickel contained in ferronickel decreased by 17%. Nickel was mined at PT Antam's sites at Pomalaa in Southeast Sulawesi Province and Gebe, Gee, and Tanjung Buli in North Maluku Province. Owing to depleted resources, Gebe was closed in 2004. The Mornopo Mine in North Maluku Province was put into operation in the fourth quarter of 2005. PT Antam planned to maintain a total output of about 3.5 Mt of saprolite and 1.2 Mt of limonite from its mines. The construction of the FeNi III smelter and the expansion of the ferronickel capacity at the Pomalaa site to 26,000 t/yr from 11,000 t/yr were underway, and operation of both was expected to begin in the first quarter of 2006. The FeNi III smelter was to use nickel ore feed from PT Antam's nickel deposits in Buli, North Baluku Province, and from PT Inco's deposit in East Pomalaa. During the past 3 years, nickel demand in China increased, but PT Antam's main ferronickel customers were in Europe and the Republic of Korea. PT Antam considered that China would be a potential future market once the FeNi III smelter started operation (Metal Bulletin, 2005; Miningindo.com, 2005b§).

Owing to the Government's decision to remove price subsidies on diesel fuel, the diesel fuel price for industrial uses increased by two-fold in Indonesia. PT Inco used high sulfur fuel oil for its furnaces. Because production costs increased, PT Inco's net earnings decreased by 5.5%. PT Inco planned to invest $250 million to increase its nickel-in-matte output capacity to 91,000 t/yr in Soroako, South Sulawesi Province, by 2009. The company was waiting for Government approval to build a new dam at Karebbe on the Larona River to raise its power-generating capacity by 33%. PT Inco also planned to develop two nickel deposits, Bahodopi in Central Sulawesi Province and Pomalaa in Southeast Sulawesi Province. The Government asked PT Inco to raise from 1% to 2% of the company's royalty and community development fund in the company plan by 2009. According to the 1996 revised COW, PT Inco will start paying a new royalty on April 1, 2008 (PT International Nickel Indonesia Tbk, 2006; Miningindo.com, 2005c§).

PT Weda Bay Nickel (a subsidiary of Weda Bay Minerals Inc. of Canada) continued its nickel exploration on the island of Halmahera in Indonesia. In 2005, Weda Bay terminated the long-term product supply agreement with OM Group Inc. of the United States. Under the terms of the agreement, Weda Bay repaid the initial loan of $2.5 million provided by OM Group. After completion of the project, Weda Bay can either pay OM Group $20 million or make an annual payment equivalent to 1% of the net smelter revenue for 30 years. At yearend 2005, the measured and indicated laterite resources in Halmahera were estimated to be 155 Mt at grades of 1.45% Ni and 0.09% Co. The company had completed a prefeasibility study, and a bankable feasibility study was begun and was expected to be completed in 2006 (Weda Bay Minerals Inc., 2005).

Tin.—Indonesia was the second ranked tin-producing country in the world behind China. The Indonesian tin sector was dominated by two companies—PT Koba Tin and PT Tambang Timah Tbk (PT Timah). Under the regional autonomy law, the Bangka Belitung Regency government was allowed to issue operating licenses to locals to smelt tin and licenses to local companies to export crude tin to China, Malaysia, and Thailand for refining. These small smelters could not sell their products directly on the international market because they did not have brand names. The products, however, were exported to Singapore, and Singapore-based traders resold the tin to major smelters in China, Malaysia, and Thailand. Indonesia replaced China as the leading tin exporting country in the world. The Central Government published tin production data only from PT Kobe Tin and PT Timah. More than 20 small tin smelters in Bangka had a combined output capacity of 60,000 t/yr. The

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Central Government had ordered the local government to stop issuing tin smelting licenses in Bangka and to collect royalties from these smelters. The total tin metal output capacity in Indonesia was estimated to be more than 130,000 t/yr (Tin Bulletin, 2006).

In 2005, PT Timah's tin concentrates output increased by 15% to 42,615 t. Offshore production was 9,373 t, which was 36% higher than that of 2004, and accounted for 22% of the company's total production. The increase in offshore output was credited to the improvement in the maintenance of dredges. Inland output was mainly from illegal miners who operated on the company's inland properties. Illegal miners also sold their output to local tin smelters; the supply of tin concentrates, therefore, was tightened and increased the acquisition costs for PT Timah. With the availability of tin concentrates, refined tin output increased by 20% to 41,799 t. PT Timah exported about 97% of its output. Even with higher sale volume and revenue, the company's operating profit was lower than that of 2004 because the per-metric-ton production cost of refined tin increased by 18% and the average per-metric-ton tin price on the world market was lower ($7,502 in 2005 and $8,482 in 2004). In an effort to increase the company's value, PT Timah diversified its business into coal and silica sand production; tin, however, remained its core business (PT Tambang Timah Tbk, 2006).

Industrial Minerals

Cement.—The Indonesian cement sector was dominated by the following producers, in order of size: the PT Semen Gresik Group, which included PT Semen Padang and PT Semen Tonasa; PT Indocement Tunggal Prakarsa; PT Holcim Indonesia; and PT Semen Andalas Indonesia. These producers accounted for 93% of the country's cement production. According to the Indonesia Cement Association, the country's total output capacity was 44.59 Mt/yr. Domestic consumption accounted for 92.8%, or 31.51 Mt, of the total output in 2005, which was 4.9% higher than that of 2004. The increase in cement consumption was from infrastructure projects in Banten and West Java. The Indonesian population was concentrated mainly in Java. Of the domestic cement consumption, almost 61% was from Java; 21%, from Sumatra; 6%, from Sulawesi; 5%, from Kalimantan; and 7%, from other areas. In 2005, exports of cement increased by 11.6% to 3.29 Mt, mainly to countries in the Asia and the Pacific region (Indonesia Cement Association, 2006).

In 1998, Cementos Mexicanos, S.A. de C.V. (CEMEX) of Mexico through its subsidiary CEMEX Asia Holdings signed a conditional sale and purchase agreement with the Indonesia Government to buy 14% of Semen Gresik shares and had the right to buy additional shares until it became majority shareholder. CEMEX purchased an additional 11.5% shares in Semen Gresik through a stock exchange. The Government held a 51% share, and the public held the remainder. The deadline for the Government to implement the option was October 1, 2001. The local government and PT Semen Padang (a subsidiary of Semen Gresik) opposed the sale. The local government passed a decree that expropriated Semen Padang from Semen Gresik. The Government planned to buy back the Semen Gresik shares from CEMEX, but CEMEX did not want to sell. In December 2004, CEMEX filed a dispute complaint with the International Center for the Settlement of Investment Disputes for the Indonesian Government to pay $500 million in damages for not upholding its contractual obligations but later decided to sell its shares in Semen Gresik to local investor Rajawali Group for $337 million. The transaction was subject to the approval of the Government and fulfillment of other conditions (Jakarta Post, The, 2006a§).

Mineral Fuels

Coal.—As a result of rising coal demand and high coal prices, Indonesian coal output increased by less than 9% to 142.9 Mt in 2005 compared with that of 2004, which was less than the Government's target output of 153 Mt. Owing to increased demand for coal in Asia, coal output was expected to increase to 160 Mt in 2006. Besides legal coal producers, Indonesia had thousands of illegal coal miners for whom the Government could account. The actual coal output could be up to 20% higher than the Government's reported figure. As the coal price rose on the international markets and China reduced its coal exports to meet domestic demand, coal exports from Indonesia increased to 128.6 Mt in 2005; of that amount, 106.9 Mt was bituminous coal. Regional exports within Asia accounted for 75% of the total. Domestic coal demand accounted for 30% of the total output. Powerplants, which were the leading consumers, accounted for 63% of the total demand, and cement plants consumed about 15% of the total. During the next couple of years, several coal-fired powerplants in the Central Java and West Java Provinces were scheduled to begin operations. Coal demand in Indonesia was expected to increase to 47.7 Mt in 2010 and to reach 72 Mt in 2020 (Petrominer, 2005b; Central Bureau of Statistics, 2006).

PT Kaltim Prima Coal (KPC) [a subsidiary of PT Bumi Resources Tbk (PT Bumi)] was Indonesia's leading coal producer. KPC was formerly jointly and equally owned by BP Amoco Indonesia and PT Rio Tinto Indonesia. According to the terms of the COW, the partners were required to divest part of their holdings to local interests. Negotiations took a long time because no Indonesian purchaser was able to obtain the financing needed to buy it. In 2003, PT Bumi acquired 100% of KPC for $500 million, including assumed debts. KPC operations were located near Sangatta, which is the capital of the East Kutai Regency in East Kalimantan Province. Since 2003, KPC has expanded mine output to 30 Mt/yr in 2005. The Bengalon Mine, which is located 25 km from the existing operation, will start production in 2006. KPC's coal production target was 36 Mt/yr in 2006 and 60 Mt/yr in 2010. Of the 90,960 ha work areas, only 15% had been exploited, including the Bengalon Mine. The total minable reserves were 634 Mt with 2,945 billion metric tons of resources. PT Bumi planned to sell 100% ownership in Arutmin Indonesia and 95% ownership in KPC and Indocoal Resources Ltd. to PT Borneo Lumbung Engergi (a subsidiary of PT Renaissance Capital) for $3.25 billion. The transaction required Government approval under the terms of the COW (Petrominer, 2006c, d).

Natural Gas and Petroleum.—In 2005, Indonesia produced an average of 1.061 million barrels per day (Mbbl/d) of oil,

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which was 98.7% of the Government target; this was a decline from the average of 1.095 Mbbl/d produced in 2004. It was the 12th consecutive year in which oil output declined. Most of the production fields were mature and depleted. Only relatively small reserves were discovered by explorers. Maintenance activities in several production fields also were plagued by floods and electricity disruptions, which hampered the efforts to raise production. The main reason for the declining oil production was the absence of new exploration during the past several years. Oil production capacity from old wells/fields was expected to continue to decline. Major international oil companies have reduced their drilling expenditures during the past several years. Chevron Indo Asia, China National Offshore Oil Co. (CNOOC), Conoco Philips Indonesia, Medco Energi International TBK's PT Exspan Nusantara, PT Pertamina, and Total E&P Indonesie were the leading oil producers. The Government set the target to produce 1.3 Mbbl/d by 2009. To meet the 1.3 Mbbl/d target, the Government offered incentives to contractors to develop marginal oilfields (U.S. Embassy, Jakarta, Indonesia, 2006, p. 12).

The Government assumed that the world oil price was $24 per barrel in its 2005 budget. The House of Representatives allocated $2.0 billion to subsidize fuel prices in the 2005 budget, which was approved in 2004 and, at the request of the Government, revised to $9.8 billion in 2005 when prices of oil increased to $55 per barrel. Because of the continuous increase in oil prices on the world market, the Government required decreasing fuel subsidies to meet the subsidized budget approved by the House of Representatives. In September 2005, the Government decided to increase prices for premium gasoline, diesel oil, and kerosene and eliminated the price disparity between industrial fuel and nonindustrial fuel. Following the price hike, average fuel consumption decreased by more than 20% by yearend. With industrial fuel no longer subsidized, cement and metal producers switched to coal to reduce production costs and raised the selling prices on their products (Petrominer, 2005a).

Indonesia had 2.56 trillion cubic meters of proven natural gas reserves, which were the largest reserves in the Asia and the Pacific region. The country started exporting liquefied natural gas (LNG) in 1977 and was the leading LNG exporter in the world. LNG was from two areas—Arun in Aceh Province and Bontang in East Kalimantan Province. Owing to a slowly depleting resource, Arun was expected to cease output in 2012. To cover the shortage of gas production from the Arun field, ExxonMobil Oil Indonesia developed two gas blocks, the Pase and the NSO. In 2005, the Government decided not to extend the production-sharing contract with ExxonMobil in Aceh Province and the company was expected to leave. Because of operational constraints, Bontang production experienced a shortfall in recent years. Indonesia's LNG production decreased to 25.2 Mt in 2004 from 29.8 Mt in 1999. A third LNG production center at Tangguh in western Papua Province, which is operated by a BP Indonesia-led consortium that includes CNOOC of China, and Japan Oil, Gas, and Metals National Corp; Mitsubishki Corp.; and Nippon Oil, Exploration, of Japan will come online in 2008. The Tangguh project had secured a $2.6 billion loan from the Asian Development Bank, the Japan Bank for International Corp., and seven other international banks. The plan for the Tangguh project was to build two LNG trains with a total production capacity of 7.6 Mt/yr. Indonesia had signed 6.9-Mt/yr LNG supply contracts with China, the Republic of Korea, and Mexico. The first LNG shipment to Fujian, China, was scheduled for 25 years by yearend 2008. In 2005, the Indonesian Government approved the construction of the Tangguh project (Petrominer, 2006i).

PT Pertamina and ExxonMobil signed a cooperation contract with BP Migas to jointly manage the Cepu oilfield and gasfield, which is located in the regencies of Bojonegoro and Tuban in East Java Province and Blora in Central Java Province. ExxonMobol has spent more than $450 million to acquire and explore in the area. The Government proposed that the two parties establish a joint-venture company in which each party has a 45% equity share and the local government has a 10% share (Petrominer, 2005c).

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Major Sources of Information

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Plaza Centris, Jl. HR. Rasuna Said, Kav B/5, Juningan
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Ministry of Energy and Mineral Resources
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Ministry of Industry and Trade
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Gedung Patra Jasa Lantai 1, 2, 13, 14, 16, 21, 22
Jl Gatot Subrota Kav 32-34
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TABLE 1
INDONESIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2001	2002	2003	2004	2005
METALS						
Aluminum:						
Bauxite, wet basis, gross weight	thousand metric tons	1,237	1,283	1,263	1,331	1,442
Metal, primary[e]		180,000	160,000	200,000	247,000 r	252,000
Chromite sand, dry basis[e]		1,000	1,000	1,000	1,000	1,000
Copper:						
Mine, Cu content		1,048,694	1,171,726	1,005,837	840,318	1,041,000
Metal						
Smelter, primary		217,500	211,200	247,400	211,600	275,000
Refinery, primary		212,500	192,400	223,300	210,500	262,900
Gold, mine output, Au content[2]	kilograms	162,605	142,238	141,019	91,710 r	130,620
Iron and steel:						
Iron sand, dry basis		469,132	378,376	245,409	89,664	21,901
Metal:						
Ferroalloys:						
Ferronickel		47,769	42,306	43,894	39,538	36,690
Ferromanganese[e]		12,000	12,000	12,000	12,000	12,000
Pig iron, direct reduced iron	thousand metric tons	1,480	1,450 r	1,170 r	1,440 r	1,268
Steel, crude	do.	2,781 r	2,462 r	2,042 r	3,682 r	3,675
Nickel:						
Mine output, Ni content[3]		102,000	123,000	143,000	133,000	160,000
Matte, Ni content		63,471	59,500	70,200	81,120 r	78,490
Ferronickel, Ni content		10,302	8,807	8,933	7,945	7,338
Silver, mine output, Ag content	kilograms	269,825	293,520	285,206	261,960 r	320,590
Tin:						
Mine output, Sn content		61,863	88,142	71,694	65,772	90,000 e
Metal[4]		53,796	67,455	66,284	49,872	65,300
INDUSTRIAL MINERALS						
Cement, hydraulic	thousand metric tons	31,100	31,500 r,e	31,000 r,e	33,230 r	33,917
Clays:[e]						
Bentonite		5,000	5,000	5,000	5,000	5,000
Fire clay	thousand metric tons	1,900	1,900	1,900	1,900	2,000
Kaolin powder		15,000	15,000	15,000	15,000	15,000
Diamond:[e]						
Industrial stones	thousand carats	23	23	23	23	23
Gem	do.	7	7	7	7	7
Total	do.	30	30	30	30	30
Feldspar[e]		24,000	24,000	24,000	24,000	24,000
Gypsum[e]		6,000	6,000	6,000	6,000	6,000
Iodine[e]		75	75	75	75	75
Nitrogen, N content of ammonia	thousand metric tons	3,665	4,200	4,250	4,120	4,400 e
Phosphate rock[e]		600	600	600	600	600
Salt, all types[e]	thousand metric tons	680	680	680	680	680
Stone:						
Dolomite[e]		3,000	3,100	3,100	3,100	3,100
Granite	thousand metric tons	3,975	4,966	3,939	3,340 r	4,170
Limestone[e]	cubic meters	16,000	16,500	16,000	16,000	16,500
Marble[e]	do.	1,000	1,000	1,000	1,000	1,000
Quartz sand and silica stone[e]	do.	145,000	145,000	150,000	150,000	150,000
Sulfur, elemental[e]		68,500	73,500	78,500	83,500	83,000
Zeolite[e]		400	400	400	400	400
MINERAL FUELS AND RELATED MATERIALS						
Coal:						
Anthracite[e]		40,807 r	42,690 r	50,000	50,000	50,000
Bituminous	thousand metric tons	92,500	103,329	114,000 e	131,530 r	142,920
Gas, natural:						
Gross	million cubic meters	79,470	85,959	89,324	83,740	85,830
Marketed[e]	do.	44,000	51,000	54,000	52,000	53,000
Petroleum, crude including condensate	thousand 42-gallon barrels	489,460	432,000	413,000	362,000	352,000

See footnotes at end of table.

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TABLE 1--Continued
INDONESIA: PRODUCTION OF MINERAL COMMODITIES[1]

[c]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised.
[1]Table includes data available through November 1, 2006.
[2]Includes Au content of copper ore and output by Government-controlled foreign contractors' operations. Gold output by operators of so-called people's mines and illegal small-scale mines is not available but may be as much as 20 metric tons per year.
[3]Includes a small amount of cobalt that was not recovered separately.
[4]Output by Central Government-controlled foreign contractors operations. Tin output from small tin smelters is not available but may be as much as 40,000 metric tons per year.
[5]Reported figure.

TABLE 2
INDONESIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Locations of main facilities	Annual capacity[c]
Aluminum:			
Bauxite	PT Aneka Tambang Tbk (Government, 65%)	Kijang, Bintan Island, Riau	1,300
Metal	PT Indonesia Asahan Aluminum (Nippon Asahan Aluminum Co. Ltd. of Japan, 59%, and Government, 41%)	Kual Tanjun, North Sumatra	270
Cement	PT Indocement Tunggal Prakarsa Tbk	Cirebon and Citeureup, West Java; Tarjun, South Kalimantan	15,600
Do.	PT Semen Andalas Indonesia	Aceh Besar	1,400
Do.	PT Semen Baturaja (Persero)	Baturaja-Ogan Komering Ulu, South Sumatra	1,250
Do.	PT Semen Bosowa Maros	Kabupaten Maros, Sulawesi Selatan	1,800
Do.	PT Holcim Tbk (former known as PT Semen Cibinong)	Narogong, East Java	9,700
Do.	PT Semen Gresik (Persero) Tbk	Gresik and Tubar, East Java	8,200
Do.	PT Semen Padang (Persero)	West Sumatra	5,440
Do.	PT Semen Tonasa (Persero)	Pangkep, Sulawesi Selatan	3,480
Coal	PT Adaro Indonesia (New Hope Corp, 50%; PT Asminco Bara Utama, 40%; Mission Energy, 10%)	Paringin and Tutupan, South Kalimantan	22,000
Do.	PT Arutmin Indonesia (PT Bumi Resources Tbk, 80%, and Bakrie Group, 20%)	Mulia, Senakin, and Satui, South Kalimantan	11,000
Do.	PT Berau Coal (PT United Tractor, 60%; PT Armadian, 30%; Nissho Iwai, 10%)	Berau, East Kalimantan	13,000
Do.	PT Kaltim Prima Coal Co. (PT Bumi Resources Tbk, 100%)	East Kutai Regency, East Kalimantan	36,000
Do.	PT Kideco Jaya Agung (Samtan Co. Ltd. of the Republic of Korea, 100%)	Pasir, East Kalimantan	12,000
Do.	PT Tambang Batubara Bukit Asam (state-owned)	Tanjung Enim and Ombilin, South Sumatra	19,000
Copper:			
Concentrate	PT Freeport Indonesia Co. (Freeport-McMoRan Copper & Gold Inc. of the United States, 81.28%; Government, 9.36%; others, 9.36%)	Ertsberg and Grasberg, Papua	800
Do.	PT Newmont Nusa Tenggara (Newmont Gold Mining Co. of the United States, 45%; Sumitomo Corp., 35%; PT Pukuafu Indah, 20%)	Sumbawa Island, West Nusa Tenggara	300
Metal	PT Smelting Co. (Mitsubishi Materials Corp., 60.5%; PT Freeport Indonesia Co., 25%; others, 14.5%)	Gresik, East Java	210
Gas:			
Natural million cubic feet per day	ExxonMobil Oil Indonesia	Arun and Aceh, North Sumatra	1,700
Do.	Roy M. Huffington (subsidiary of HUFFCO Group of the United States)	Badak, East Kalimantan	1,000
Do.	Total Indonesie	Offshore, East Kalimantan	2,100
Liquefied	PT Arun LNG Co. Ltd. (Government, 55%; Mobil Oil, 30%; Japan Indonesia LNG Co., 15%)	Balang Lancang amd Aceh, North Sumatra	10,000
Do.	PT Badak LNG Co. Ltd. (Government, 55%; HUFFCO Group, 30%; Japan Indonesia LNG Co., 15%)	Bontang, East Kalimantan	7,900

See footnote at end of table.

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TABLE 2--Continued
INDONESIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Locations of main facilities	Annual capacity[e]
Gold metric tons	Aurora Gold Ltd. (100%)	Balikpapan, Central Kalimantan	60
Do.	PT Aneka Tambang Tbk (Government, 65%)	Bogor, West Java	3
Do.	PT Freeport Indonesia Co. (Freeport-McMoRan Copper & Gold Inc. of the United States, 81.28%; Government, 9.36%; others, 9.36%)	Ertsberg and Grasberg, Papua	110
Do.	PT Newmont Nusa Tenggara (Newmont Gold Mining Co. of the United States, 45%; Sumitomo Corp., 35%; PT Pukuafu Indah, 20%)	Sumbawa Island, West Nusa Tenggara	16
Do.	PT Nusa Halmahera (PT Aneka Tambang Tbk, 17.5%, and PT Newcrest Mining Ltd. 82.5%)	Halmahera Isand, Maluku	24
Do.	PT Prima Lirang Mining (Billiton BV of the Netherlands, 90%, and PT Prima Maluku Indah of Indonesia, 10%)	Lerokis, Wetar Island	3
Nickel:			
In ore	PT Aneka Tambang Tbk (Government, 65%)	Pomalaa, South Sulawesi and on Gebe Island	80
Do.	PT International Nickel Indonesia Tbk (Inco Ltd. of Canada, 59%; Sumitomo Metal Mining Co. Ltd. of Japan, 20%; others, 21%)	Soroako, South Sulawesi	70
In matte	PT Aneka Tambang Tbk (Government, 65%)	Pomalaa, South Sulawesi	24
Do.	PT International Nickel Indonesia (Inco Ltd. of Canada, 59%; Sumitomo Metal Mining Co. Ltd. of Japan, 20%; others, 21%)	Soroako, South Sulawesi	68
Nitrogen	PT Aseah-Aech Fertilizer (Government, 60%, and other members of the Association of Southeast Asian Nations, 40%)	Lhokseumawe, North Sumatra	506
Do.	PT Pupuk Iskandar Muda (Government, 100%)	do.	506
Do.	PT Pupuk Kalimantan Timur (Government, 100%)	Bontang, East Kalimantan	1,010
Do.	PT Pupuk Sriwijawa (Government, 100%)	Palembang, South Sumatra	1,440
Petroleum, crude thousand barrels per day	Atlantic Richfield Indonesia, Inc. (subsidiary of Arco Co. of the United States)	Arjuna and Arimbi, offshore West Java	170
Do.	China National Offshore Oil Co.	Off of southeast Sumatra	100
Do.	Maxus Southeast Asia Ltd. (subsidiary of Maxus Energy of the United States)	Cinta and Rama, offshore Southeast Sumatra	95
Do.	Pertamina (Government, 100%)	Jatibarang, West Java, and Bunyu, offshore East Kalimantan	80
Do.	PT Caltex Pacific Indonesia (Texaco Inc., 50%, and Chevron Corp., 50%, both of the United States)	Minas, Duri, and Bangko, central Sumatra	700
Do.	Total Indonesie (subsidiary of Compagnie Francaise des Petroles of France)	Handi and Bakapai onshore and offshore East Kalimantan	180
Silver	PT Aneka Tambang Tbk (Government, 65%)	Bogor, West Java	25
Do.	PT Freeport Indonesia Co. (Freeport-McMoRan Copper & Gold Inc. of the United States, 81.28%; Government, 9.36%; others, 9.36%)	Ertsberg and Grasberg, Papua	220
Do.	PT Kelian Equatorial Mining (Rio Tinto Group, 90%; PT Harita Jaya Raya, 10%)	180 kilometers west of Samarinda	10
Steel, crude	PT Ispat Indo	Sidoarjo, Surabaya	700
Do.	PT Krakatau Steel (Government, 100%)	Cilegon, West Java	2,400
Do.	PT Komatsu Indonesia Tbk	Jakarta	8
Do.	PT Wahana Garuda Lestari	Pulogadung, Jakarta	410
Tin:			
In ore	PT Koba Tin (Malaysia Smelting Corp., 75%, and PT Tambang Timah Tbk, 25%)	Koba, Bangka Island	25
Do.	PT Tambang Timah Tbk (Government, 65%)	Onshore and offshore islands of Bangka, Belitung, and Singkep	60
Metal	Mentok Tin Smelter (PT Tambang Timah Tbk)	Mentok, Bangka Island, South Sumatra	68
Do.	Koba Tin Smelter (PT Koba Tin)	Koba, Bangka Island, South Sumatra	25

[e]Estimated; estimated data are rounded to no more than three significant digits.

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THE MINERAL INDUSTRY OF JAPAN

By John C. Wu

Japan is located in East Asia between the North Pacific Ocean and the Sea of Japan (East Sea) and east of the Korean Peninsula. The country's total area is 377,915 square kilometers, and its population as of August 2005 was estimated to be 127.76 million (Ministry of Internal Affairs and Communications, 2006§[1]). Japan's economy ranked second after the United States among the G7 major advanced economies and, in 2005, it had a gross domestic product (GDP) of $4.6 trillion ($3.9 trillion based on purchasing power parity); its per capita GDP was $35,757 ($30,615 based on purchasing power parity) (International Monetary Fund, 2006§).

Japan has limited indigenous mineral resources and relied heavily on imports of a wide variety of minerals and mineral products to meet the raw material requirements of its large manufacturing and utility (electricity and gas) sectors. The country, however, has substantial indigenous resources of dolomite, iodine, limestone, pyrophyllite, silica sand, and silica stone (table 3).

Japan's manufacturing and utility sectors were among the largest, in terms of capacity, in the world. The mineral industry processed imported raw materials and produced a broad category of mineral products, which included chemical compounds, construction materials, ferrous metals, fertilizer materials, industrial minerals, inorganic chemicals, nonferrous metals, petrochemicals, and refined petroleum products, for domestic consumption by the downstream industries in the construction and manufacturing sectors and for export to world markets. The electricity and gas industries used imported coal, natural gas, petroleum, uranium, and other nuclear fuel materials to produce electricity and processed natural gas to meet the energy requirements of the construction, manufacturing, mining, and other sectors of the economy.

In 2005, Japan was one of the world's top importers and consumers of primary aluminum, cadmium metal, coal, cobalt metal, copper ore and metal, diamond, ferrochromium, ferronickel, fluorspar, gallium metal, gold metal, iron ore, ilmenite and rutile, indium metal, lead ore and metal, lithium metal, manganese ore and metal, magnesium, liquefied natural gas (LNG), nickel ore and metal, crude petroleum, platinum-group metals (PGM), phosphate rock, potash, rare earths, industrial salt, silicon metal, silver metal, tungsten ore and ammonium tungstate, tin metal, zinc ore and metal, and zircon. Japan was one of the world's major producers and exporters of fabricated aluminum and copper products, cement and cement products, ceramic products, refined copper, inorganic chemicals, compound fertilizers, electrolytic manganese dioxide (EMD), glass and glassware products, iodine, high-purity rare (minor) metals, iron and steel, and titanium sponge metal and titanium products.

[1]References that include a section mark (§) are found in the Internet References Cited section.

The mining sector was the smallest sector of Japan's industry-based economy. According to the Government statistics on real GDP by economic activities of Japan's national accounts, the mining sector accounted for only 0.11% of the real GDP in 2004 (the latest year for which data were available). The mineral industry, which included the mineral processing industries, accounted for 5.5% of the real GDP, as follows: processing of chemicals, 1.84%; of iron and steel, 0.86%; of fabricated metal products, 0.84%; of petroleum and coal products, 0.80%; of industrial mineral products, 0.68%; and of nonferrous metals, 0.37%; as well as mining, 0.11% (Economic and Social Research Institute, 2006b§).

The Japanese economy, as measured by the real GDP in 2000 constant prices, grew by 2.6% compared with 2.3% (revised) in 2004. The higher economic growth in 2005 was fueled by a 3.2% growth in private demand owing largely to a 7.7% increase in private nonresidential investment in plants and equipment (Economic and Social Research Institute, 2006a§).

Japan's industrial production, as measured by the indices of mining and manufacturing, increased by 1.1% in 2005 compared with 5.5% (revised) in 2004. The number of unemployed workers in Japan decreased to 2.94 million from 3.13 million (revised) in 2004, and the total labor force increased to 66.5 million from 66.4 million in 2004. As a result, the unemployment rate in Japan decreased to 4.4% from 4.7% in 2004. Japan's merchandise trade surplus dropped to $79.0 billion from $110.5 billion in 2004 mainly because of a substantial increase in the unit prices of imported raw materials. The change in Japan's consumer price index was a negative rate of 0.3% (0.3% deflation) in 2005 compared with a rate of 0% (no deflation or inflation) in 2004 (Japan Institute for Labor Policy and Training, 2006§).

Government Policies and Programs

To implement its mineral policies and undertake its mineral programs, the Japanese Government established Japan Oil, Gas and Metals National Corp. (JOGMEC) under the supervision of the Ministry of Economy, Trade, and Industry (METI) in February 2004 with the objective of securing a stable supply of natural resources and energy. To achieve this objective, JOGMEC provides assistance by offering its knowledge, information, and technological expertise to support Japanese companies at various stages between the acquisition of exploration and production rights and production; assumes responsibility for the management of the national stockpile of crude oil, liquefied petroleum gas (LPG), and rare metals; and supports activities to control domestic and overseas mine pollution. According to JOGMEC, for fiscal year 2006, which began on April 1, 2005, and ended on March 31, 2006, the Government budget for metals-related activities (excluding oil and gas) totaled about $61 million. JOGMEC's metals-related activities had about 200 professional staff members; 35 of

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whom were geologists. The Metals Strategy & Exploration Unit of JOGMEC provides mineral resource information services, conducts domestic and overseas exploration and geologic surveys, finances domestic and overseas mineral exploration and development projects, supports technology development projects, administers stockpiling of rare metals (chromium, cobalt, manganese, molybdenum, nickel, tungsten, and vanadium), and conducts mine pollution control activities for domestic abandoned mines (Sakasegawa, 2006, p. 2-4).

To contribute to a stable supply of mineral resources for Japan and to accelerate mineral production and economic growth in developing countries, the former Metal Mining Agency of Japan started a mineral exploration program, which was called the Joint Basic Exploration Scheme (JBES) with an initial annual budget of $5 million in fiscal year 2003. JOGMEC continued the JBES program and increased its annual budget to about $11 million in fiscal year 2005 (Japan Oil, Gas and Metals National Corp., 2005).

The JBES' targeted commodities are, in order of priority, copper, zinc, nickel, platinum-group metals, and rare metals, which include such metals as cobalt, chromium, manganese, rare earths, tantalum, titanium, tungsten, and others. The potential joint-venture partners of the JBES include those state-owned mineral enterprises, regional government organizations, local geological survey agencies, private mining companies, multinational major mining companies, and junior mining companies that hold exploration licenses and have the power to sign and carry out the JBES contract terms. A typical JBES agreement includes a minimum work and expenditure commitment and farm-in arrangements for projects that are expected to last from 1 to 5 years. For any JOGMEC interest acquired through the joint-venture exploration, the agreement includes a provision that JOGMEC may transfer its interest to a proper successor after completion of the project period.

In 2005, JOGMEC's ongoing 15 JBES projects included one project in Argentina, two projects in Australia, one project in Brazil, three projects in Chile, three projects in Indonesia, one project in Mexico, three projects in Peru, and one project in Papua New Guinea. Most of the ongoing projects were joint ventures with Japanese and foreign private mining companies. JOGMEC's JBES budget was sourced from the METI; a typical annual budget for a JBES project was between $100,000 and $1 million. The budget cycle for each JBES project conforms to the Japanese fiscal year (Japan Oil, Gas and Metals National Corp., 2004; Sakasegawa, 2006, p. 12).

In August 2005, JOGMEC signed an agreement for a JBES project with Almaden Minerals Ltd. of Canada to jointly conduct exploration for copper, lead, silver, and zinc in the Sierra Madre Occidental area in Mexico. Under the agreement, the exploration project consists of a regional exploration program and exploration of the Santa Isabela property, which is located in Coahuila State, Mexico, and was owned by Almaden Minerals. The regional exploration program was to focus on extracting prospects and identifying new properties. For the regional exploration program, JOGMEC could acquire a 51% interest in the property by spending $700,000 for exploration by March 31, 2007, and could acquire a total of 60% by spending an additional $500,000 for exploration for each designed property. For the Santa Isabela program, JOGMEC could acquire a 51% interest by spending $1 million for exploration by March 31, 2007, and could acquire a total of 60% interest by spending an additional $500,000 for exploration by September 30, 2008 (Japan Oil, Gas and Metals National Corp., 2005§).

Environmental Issues

The amended Enforcement Order of Industrial Safety and Health Law, which largely prohibited the use of asbestos in Japan, took effect on October 1, 2004. As a result of the widespread use of asbestos in buildings as insulation and in roof tiles during the 1970s and the 1980s, Japan continued to suffer from asbestos-related deaths. According to the weekly reports in July 2005 by the Hong Kong-based Corporate Social Responsibility in Asia, several Japanese asbestos product-producing companies publicly disclosed that many of their employees and visitors to their factory premises had died of asbestos-related illnesses since the late 1970s. Numerous studies have linked asbestos exposure to lung cancer or mesothelioma, and pneumoconiosis. As of mid-2005, the companies that had publicly disclosed asbestos-related deaths included industrial equipment manufacturer Kubota Corp., building materials manufacturer Nichias Corp., ceramics and building materials manufacturer A&A Material Corp., and such major building materials producing companies as Asahi Glass Co. Ltd., Mitsubishi Materials Corp., Nozawa Corp., and Taiheiyo Cement Corp. (Corporate Social Responsibility in Asia, 2005a§, b§).

According to a press report by the Asahi Shimbun in September, the Government decided in August 2005 to draft legislation to extend relief to those who had suffered from asbestos-related health problems, including people who live near factories and factory worker's family members. The Government planned to make families of asbestos victims eligible for the same level of benefits as those available under workers' accident compensation insurance. The family would be able to receive payout even if they failed to apply for workers' accident compensation insurance within the legal limit of 5 years following the victims' deaths. The bill was expected to be submitted to an ordinary Diet (Parliament) session in 2006. To finance relief measures, the Government planned to seek contributions from asbestos-related businesses (Mines & Communities, 2005§).

In August, the Japanese Government announced that it had ratified the International Labor Organization Convention 162 on safety in the use of asbestos. The Government submitted the ratification instrument to the International Labor Office in Geneva, Switzerland, on August 10, 2005. The convention was expected to take effect in Japan on August 11, 2006. The convention specified the following measures to prevent health risks from asbestos: 1) promote the replacement of asbestos by other materials and the total or partial prohibition of the use of asbestos, 2) prohibit the use of the more-hazardous crocidolite (blue asbestos) and products that contain this fiber and the spraying of all forms of asbestos, 3) take adequate health and safety measures when demolishing structures that contain asbestos and when removing asbestos from buildings

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or structures, and 4) take such measures to protect workers as setting exposure limits, monitoring the work environment, and providing workers with all necessary protection, health checkups, information, and education (Japan for Sustainability, 2005§).

Production

In 2005, mine production of all nonferrous metals (except gold) declined because of depleting ore reserves; production of most industrial minerals (except clays, dolomite, and nitrogen) increased. Mine production of lead, silver, and zinc at the Toyoha Mine in Hokkaido Prefecture decreased because of a sudden increase of water flow into the mine during April and May (Metals Place, 2005b§). Because of depleting ore reserves, the Toyoha Mine was scheduled to be closed by the end of March 2006 (Mining Journal, 2005b). Limestone production increased because of increased consumption by the cement and construction industries. Japan's coal output decreased owing to closure of four small-scale coal mines early in the year. According to Japan Coal Energy Center, less than seven small-scale open pit coal mines and one major underground coal mine operated in Hokkaido Prefecture in 2005 (Japan Coal Energy Center, 2005). The output of crude petroleum and natural gas continued to increase but remained insignificant when compared with Japan's requirements.

In the mineral-processing sector, production of refined copper, gold, rare-earth oxides, tin, titanium, and zinc increased but production of other nonferrous metals, such as antimony oxide, chromium metal, lead, nickel, silver, and tungsten, decreased. Production of crude steel also decreased but remained at about the same level [(120 million metric tons (Mt)] as that of 2004 owing to the stronger domestic demand for the manufacture of automobiles and increased exports to Taiwan and Thailand. Production of titanium sponge metal continued the upward trend begun in 2004 owing to increased domestic demand and increased exports to the United States. Production of cement and other construction-related materials was higher than that of 2004 because of increased demand for the construction of dwellings and of such buildings as factories, plants, and warehouses. Production of most refined petroleum products was higher in 2005 because of increased domestic demand for gasoline, distillate fuel oil, kerosene, LPG, and naphtha (table 1).

Trade

Japan remained a net importer of minerals because of its large import bills for mineral fuels. Japan's mineral trade deficit increased to $172.7 billion from $98.6 billion in 2004. The sharp increase in the 2005 mineral trade deficit was caused mainly by a 34% increase in import bills for mineral fuels and a 41% increase in import bills for ferrous and nonferrous metal ores (table 4).

In 2005, Japan's total imports of minerals increased by 56.5% to $232.1 billion and accounted for 44.9% of the total imports, which were valued at $516.8 billion. The higher import bills for minerals was a direct result of higher import unit prices of all minerals, especially for such raw materials as ferrous and nonferrous metal ores, crude petroleum, and LNG. Of the $232.1 billion worth of mineral imports, $133.4 billion (57.5%) was for such mineral fuels as coal, LNG, crude petroleum, partially refined petroleum, refined petroleum products, and other mineral fuels; $14.4 billion (6.2%), for ores and concentrates of ferrous and nonferrous metals, slag, scrap, and ash of iron and steel, other metals, and metal compounds; and $1.5 billion (0.7%), for such industrial minerals as cement, earths and stone, lime, plastering materials, salt, and sulfur. Imports of processed minerals, mineral-related chemicals, and metals totaled $41.8 billion, of which $23.8 billion was for products of iron and steel and nonferrous, rare, and other base metals; $8.4 billion, for precious and semiprecious stones and precious metals; $5.5 billion, for mineral-related chemicals and fertilizers; and $4.1 billion, for articles and products of asbestos, cement, ceramics, glass, mica, and stone (Ministry of Finance, 2005b, p. 9-13, 15-16, 34-41).

The total exports of minerals, mineral-related chemicals, and processed mineral products increased by 19.6% to $59.5 billion in 2005 and accounted for 10% of Japan's total exports, which were valued at $595.8 billion. Exports of iron and steel products and nonferrous, rare, and other base metals totaled $42 billion. Exports of processed mineral articles and products of asbestos, cement, ceramics, glass, mica, and stone were valued at $6.4 billion. Exports of cement, earths and stone, mineral fuels, lime, ferrous and nonferrous metal ores, plastering materials, salt, and sulfur were valued at $5 billion. Exports of mineral-related chemicals and fertilizer were valued at $3 billion. Exports of precious and semiprecious stones and precious metals were valued at $3 billion (Ministry of Finance, 2005a, p. 9-13, 15-16, 34-41).

Structure of the Mineral Industry

Japan's mineral industry consisted of a small mining sector of coal and nonferrous metals, a large mining sector of industrial minerals, and a large mineral-processing sector of ferrous and nonferrous metals and industrial minerals (table 2). Mining and mineral-processing businesses were owned and operated by private companies incorporated in Japan.

In the mining sector, the number of major nonferrous metal mines remained at two in 2005. The major industrial mineral mines (mostly limestone quarries) totaled about 40. The coal mining sector consisted of seven small-scale open pit mines and one major underground mine (Kushiro) in Hokkaido Prefecture.

Japan's mining capacity of nonferrous metals (mainly lead, silver, and zinc) and coal continued to decline in 2005. The number of persons employed by the mining sector dropped to 30,000 in 2005 from 40,000 in 2004 (Statistical Handbook of Japan, 2006§).

In the mineral-processing sector, the iron and steel industry's employees increased to 157,512 from 154,578 at the end of 2004. The industry's production capacity of pig iron increased to 83.34 million metric tons per year (Mt/yr) from 82.00 Mt/yr at the end of 2004, and the production capacity of crude steel also increased to 124.12 Mt/yr from 120.79 Mt/yr at the end of 2004. In the nonferrous metals industry (which included smelting and refining of copper, gold, lead, silver, zinc, and other minor

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metals), the total number of employees decreased to 5,105 from 5,148 at the end of 2005. In 2005, Japan's production capacity of refined copper increased by 6.4% to 1,554,000 metric tons per year (t/yr); refined gold remained unchanged at 186 t/yr; refined lead remained unchanged at 275,000 t/yr; refined silver remained unchanged at 2,800 t/yr; and refined zinc remained unchanged at 750,000 t/yr. Japan's cement industry cut the number of its regular employees by 1.07% to 3,313 and held its cement clinker capacity unchanged at 76.0 Mt/yr during 2005 (Ministry of Economy, Trade and Industry, 2005a, p. 127, 130; 2005c, p. 107-108, 162, 164).

Commodity Review

Metals

Antimony.—Japan relied on imports to meet all its raw material requirements for the production of antimony trioxide and metal. The main use of antimony trioxide was for making flame retardants and chemicals; the main use of antimony metal was for making batteries, specialty steel, and hard lead casting.

In 2005, Japan imported 40 metric tons (t) of antimony ore and concentrate from China and 10 t from Vietnam; 220 t of antimony oxide from China; and 7,635 t of antimony trioxide mainly from China (89.0%), Mexico (7.8%), and Taiwan (2.4%). The import bills for antimony ore, oxide, and trioxide totaled $24.4 million (Ministry of Finance, 2005b, p. 171, 184).

Nihon Seiko Co. Ltd. was Japan's leading producer of antimony trioxide and accounted for more than 71.5% of total antimony trioxide production. Other antimony trioxide producers were Toko Sangyo Co. Ltd. and Yamanaka Sangyo Co. Ltd. Toko Sangyo was Japan's leading antimony metal producer and accounted about 90% of total antimony metal production. The other producer of antimony metal was Nihon Seiko.

Domestic demand for antimony metal totaled 455 t in 2005, of which 209 t was for the production of specialty steel; 114 t, for storage batteries; 47 t, for hard lead casting; and 85 t, for other uses (Ministry of Economy, Trade and Industry, 2005c, p. 278). Antimony trioxide was used as a flame retardant additive (93%) in fibers, plastics, and rubbers; and as pigment and for other uses (7%) (Arumu Publishing Co. Ltd., 2006, p. 54). High-purity antimony metal that contained between 99.9% and 99.999% Sb was used as raw material for semiconductors, in film for optical memory disks, and in thermoelectron converters. Antimony metal that contained between 97% and 99% Sb was used in making antimony alloys for storage batteries, for bearing metals for hard lead castings, cable sheathing, type-metals, sheet and pipe alloys, and for glass fining agents and alloys (Nihon Seiko Co. Ltd., 2006a§, b§).

In 2005, Japan exported 254 t of antimony metal mainly to Taiwan (95%) and Thailand (4%). Exports of 2,151 t of antimony oxides went mainly to Thailand and Malaysia (12.3% each), Singapore (12.0%), the Republic of Korea (11.5%), China (10.9%), Indonesia (9.9%), Taiwan (8.8%), and the United States (8.1%). Export earnings from antimony oxides and metal were valued at $11.9 million and $605,200, respectively (Ministry of Finance, 2005a, p. 116, 595).

Bauxite and Alumina and Aluminum.—In 2005, Japan relied 100% on imports of bauxite for the production of alumina and aluminum hydroxide. Imports of bauxite decreased by 6.8% to 1.8 Mt and were valued at $70.5 million in 2005. The major supplying countries of bauxite were Australia (44.7%), Indonesia (37.3%), and India (13.4%). Production of alumina and aluminum hydroxide was by Nippon Light Metal Co. Ltd. (NLM) at its Shimizu plant in Shizuoka Prefecture, which had the capacity to produce 365,000 t/yr of aluminum hydroxide and 163,000 t/yr of alumina; Showa Denko K.K. (SDK) at its Yokohama plant in Kanagawa Prefecture, which had the capacity to produce 220,000 t/yr of aluminum hydroxide and 105,000 t/yr of alumina; and Sumitomo Chemical Co. Ltd. at its Ehime plant in Ehime Prefecture, which had the capacity to produce 200,000 t/yr of aluminum hydroxide and 105,000 t/yr of alumina (Japan Aluminum Association, 2003, p. 11).

Production of primary aluminum (unwrought aluminum) by NLM at the Kambara smelter in Shizuoka Prefecture increased slightly to 6,500 t from 6,400 t in 2004, but the amount was insignificant compared with Japan's annual requirements for primary aluminum. In 2005, imports of primary aluminum decreased by 1.5% to 2.98 Mt and were valued at $3.8 billion, of which 1.99 Mt was ingot and 989,418 t, alloys (Ministry of Finance, 2005b, p. 672-673).

More than 46% of the total primary aluminum imports came from Japan's overseas aluminum smelter projects in Australia, Brazil, Canada, Indonesia, Mozambique, New Zealand, and Venezuela. Japan imported primary aluminum and aluminum alloy from more than 57 countries worldwide. Among those countries, the major suppliers were Russia (25.1%), Australia (18.9%), China (10.7%), Brazil (7.6%), New Zealand (7.2%), South Africa and Canada (5.4% each), Indonesia (5.1%), and United Arab Emirates and Venezuela (3.5% each). The United States supplied only 8,106 t and accounted for less than 0.3% of Japan's imports of primary aluminum and aluminum alloys (Ministry of Finance, 2005b, p. 672-673).

Consumption of primary aluminum totaled about 2.28 Mt, of which about 1.8 Mt was for aluminum rolled products and the remainder was for die-casting, wire and cable, and other products. Exports of primary aluminum totaled 34,420 t, of which aluminum ingots accounted for 12,936 t, and aluminum alloys, 21,483 t. The total exports were valued at $73.1 million. The major buyers of aluminum ingot were Thailand (72.8%), Vietnam (12.4%), and China (9.7%). The major buyers of aluminum alloys were the Republic of Korea (21.2%), Australia (15.7%), China (15.4%), Vietnam (12.1%), Indonesia (9.9%), Saudi Arabia (7.1%), and the Philippines (5.7%) (Ministry of Finance, 2005a, p. 584).

According to the Japan Aluminum Association, overall demand (domestic demand and exports) for aluminum products increased to 4.35 Mt from 4.33 Mt in 2004. Domestic demand for aluminum products by end-use in 2005 was as follows: 38.2% for transportation, 15.4% for building and construction, 11.8% for fabricated metal, 10.5% for food packaging, 3.8% each for communication machinery and industrial machinery, and 10.9% for others; 5.6% was for exports (Japan Aluminum Association, 2006§).

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Chromium.—Japan relied on imports to meet all chromium ore and concentrate requirements for the production of ferrochromium and chromium metal powder. Japan's imports of chromium ore and concentrate dropped by 61.7% to 104,004 t and were valued at $21.8 million in 2005. The major suppliers were India (53.4%), South Africa (25.1%), and Pakistan (11.9%) (Ministry of Finance, 2005b, p. 171).

Domestically produced ferrochromium continued the 2001 downward trend and decreased by 8% to about 12,400 t in 2005 owing to the shutdown of JFE Steel Corporation's East Japan Refinery in Chiba Prefecture because of environmental problems and increased imports of high-carbon ferrochromium. In 2005, imports of ferrochromium increased by 4.3% to 1,019,500 t and were valued at $950 million. The major overseas suppliers of ferrochromium were South Africa (50.9%), Kazakhstan (27.3%), Zimbabwe and India (6.2% each), Russia (4.9%), and China (3.8%) (Ministry of Finance, 2005b, p. 630).

In April 2005, SDK announced that it had decided to withdraw from Middelburg Technochrome (MTC) and would sell its shares in MTC. MTC had been established as a joint venture of Samancor Ltd. (65.5%) of South Africa and SDK (20.7%) and Marubeni Corporation (13.8%) of Japan for the production of low-carbon ferrochromium in 1995. According to SDK, MTC's financial performance had deteriorated substantially since 2003 because of the sharp appreciation of the South African Rand. Based on an agreement signed on March 31, 2005, SDK was to dissolve the joint-venture agreement and to transfer its shares in MTC to Samancor Ltd. SDK was expected to withdraw completely from the ferroalloys business and to form a group of inorganic materials companies (Showa Denko K.K., 2005§).

Consumption of ferrochromium increased by 1.6% to 922,800 t, of which 874,700 t was high-carbon ferrochromium and 48,100 t, low-carbon ferrochromium (Ministry of Economy, Trade and Industry, 2005c, p. 216). Exports of ferrochromium increased by 34.6% to 3,495 t, of which 3,430 t was low-carbon ferrochromium and 65 t, high-carbon ferrochromium. Export earnings of ferrochromium were $9.7 million in 2005. The principal buyers of low-carbon ferrochromium were the United States (90%) and Thailand (8%). The principal buyers of high-carbon ferrochromium were Indonesia (47.5%) and the Republic of Korea (29.3%) (Ministry of Finance, 2005a, p. 501).

In 2005, the sole producer of chromium metal was Nippon Denko Co. Ltd., which operated an 800-t/yr plant at Oshima in Toyama Prefecture; the plant used the aluminothermic reduction method. Nippon Denko produced about 700 t chromium metal in 2005. No chromium metal production was reported by JEP Materials in 2005. To supplement the domestic chromium metal production shortfall in 2005, Japan imported 4,498 t of chromium ingot and powder, which was worth $48 million, to meet its demand for chromium metal. The major suppliers were China (61.9%), the United States (16.0%), France (10.9%), and the United Kingdom (7.8%) (Ministry of Finance, 2005b, p. 681; Roskill's Letters from Japan, 2006a).

In Japan, chromium metal was consumed mainly for the manufacture of electronic materials, heat-resisting steel, and super alloys. In 2005, domestic consumption of chromium metal was estimated to be 4,500 t, of which about 60% was for making superalloys; about 20%, for nonferrous alloys; and the remaining 20%, for making welding rods and other materials. In 2005, Japan exported 558 t of chromium ingot and powder, which was worth $14 million. The major buyers were the United States (53.1%) and the United Kingdom (37.1%) (Ministry of Finance, 2005a, p. 595).

Copper, Lead, and Zinc.—Toyoha Mining Co. Ltd., which operated the Toyoha Mine in Hokkaido Prefecture, was Japan's only lead and zinc mining company. In 2005, the mine produced 299,000 t of ore, and the mill produced 41,452 t of zinc and 3,437 t of lead in concentrates; the mine also produced about 54 t of byproduct silver, an estimated 15 to 20 t of byproduct indium, and a small amount of copper. In 2005, Japan relied on imported ores and concentrates for 88% of its copper smelters' and refineries' raw materials requirements, 47% of its lead smelters' and refiners' raw material requirements, and 77% of its zinc smelters' and refineries' raw material requirements (Ministry of Economy, Trade and Industry, 2005d, p. 136; Japan Mining Industry Association, 2006, p. 63, 78. 92, 134, appendix p. 15-16).

Japan was one of the world's major importers of copper, lead, and zinc concentrates. Imports of copper concentrate, in gross weight, declined by 3.1% to 4.3 Mt in 2005. Despite the reduced import volume, the import bills of copper ore and concentrates increased by 26.3% to $4.8 billion because of increased import unit prices. The major suppliers of copper concentrate were Chile (44.8%), Indonesia (19.1%), Australia (9.9%), Canada (9.0%), Papua New Guinea (6.5%), and Peru (5.7%) (Ministry of Finance, 2005b, p. 170).

Imports of lead ore and concentrates (in gross weight) increased by 22% to 171,606 t. The import bills of lead ore and concentrates increased by 31% to $135.3 million. The major suppliers of lead ore and concentrate were the United States (47.8%), Australia (37.5%), and Peru (6.4%). Imports of zinc ore and concentrates (in gross weight) decreased by 7.2% to 1.04 Mt. The import bills for zinc ore and concentrates increased by 27% to $434 million. The major suppliers of zinc ore and concentrate were Australia (35.8%), Peru (16.4%), the United States (14.6%), Bolivia (10.9%), Canada (6.1%), Russia (4.1%) and Chile (3.9%) (Ministry of Finance, 2005b, p. 170).

On March 22, 2005, Sumitomo Metal Mining Co. Ltd. (SMM) and Sumitomo Corp. (SC) jointly announced that they had executed the definitive agreements with Compania de Minas Buenaventura S.A.A. (Buenaventura) of Peru and Phelps Dodge Corp. (PDC) of the United States to acquire an equity position in Sociedad Minera Cerro Verde S.A.A. (Cerro Verde), which operated a copper mine near Arequipa, Peru. The agreements were made to enable SMM and SC to secure more captive copper concentrate from overseas nonferrous metals mines to meet the raw materials requirements of SMM copper smelter's production capacity, which would be expanding to 365,000 t/yr by July 2005, to 410,000 t/yr by early 2006 and, ultimately, to 450,000 t/yr by March 2008 (table 8). Before March 2005, Phelps Dodge had owned 82.5% of Cerro Verde's outstanding shares, Buenaventura had owned 9.2%, and the remainder was publicly traded on the Lima Stock Exchange. On June 6, SMM and SC jointly announced the completion of their acquisition

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of a 21% equity interest in Cerro Verde for $265 million. SMM and SC would purchase 50% of Cerro Verde's copper concentrate production during the first 10 years and, after 10 years, the purchase amount would be reduced to 21%, which is equal to its equity interest. According to SMM, Cerro Verde produced about 90,000 t/yr of copper cathode. Upon completion of the expansion in early 2007, the mine would produce copper ore and concentrate that contained about 180,000 t/yr of copper (Sumitomo Metal Mining Co. Ltd., 2005d§, e§)

On June 1, 2005, SMM and SC jointly announced that they had reached an agreement in principle with PDC to acquire an equity position in Compania Contractual Minera Ojos del Salado (Ojos del Salado Mine), which was 100% owned by PDC. The underground copper mine, which is located about 4 kilometers (km) northeast of Candelaria copper mine near Tierra Amarilla in north central Chile, produced about 60,000 t/yr of copper concentrate that contained about 18,000 t/yr of copper. Under the agreement, SMM and SC would jointly obtain a 20% interest in the Ojos del Salado copper mining operation and the associated exploration properties in the Punta del Cobre District, which were owned by PDC. SMM and SC had agreed to invest $25 million to acquire a 20% interest by subscribing in new shares of Ojos del Salado. SMM would hold 16% (80% of the 20% equity position) and SC, 4% (20% of the 20% equity position) in Ojos del Salado. Under the agreement, SMM and SC would have the right to purchase at least 20% of the copper concentrate produced from the Ojos del Salado Mine and future production from the Punta del Cobre District (Sumitomo Metal Mining Co. Ltd., 2005h§).

On October 4, 2005, SMM and SC jointly announced that they had reached an agreement with PDC to restart the idled copper concentrator and to construct a concentrate leaching facility to produce copper cathode at the Morenci copper mine site in Arizona; the complex was operated by the Morenci Mining Joint Venture, which was a joint venture of PDC, SMM, and SC. About $210 million had been approved for the project, which was scheduled to begin operation in 2007. SMM and SC would spend about $31 million, which was approximately equivalent to their 15% joint interest in the Morenci Mining Joint Venture (Sumitomo Metal Mining Co. Ltd., 2005e§).

In 2005, Japan's metal production of copper increased by 1.1% mainly because of a 30% increase in exports of refined copper. Metal production of refined lead decreased by 3.1% owing to a 20% decrease in domestic demand despite a 50% increase in exports of refined lead. Metal production of slab zinc increased by 1.2% despite a 4% decline in domestic demand and a 13% decline in exports of slab zinc; the overall stock of slab zinc increased by 37% during the year.

SMM continued to undertake its copper expansion project at the Toyo smelter and refinery complex at Saijyo, Ehime Prefecture. The copper-refining capacity was raised to 365,000 t/yr in June 2005 and was expected to be increased further to 410,000 t/yr in fiscal year 2006. The acquisition of a 16.8% equity interest in the Cerro Verde copper mine in Peru was part of the company's basic strategy to secure more than 60% of the captive copper ore and concentrate to feed the planned increase in the refined copper production capacity at the Toyo Smelter. For the next 10 years starting in fiscal year 2006, SMM would take 90,000 t of copper contained in copper concentrate from the Cerro Verde copper mine (Sumitomo Metal Mining Co., Ltd., 2005a§, p. 17).

On June 16, 2005, SMM announced that it had successfully developed a new hydrometallurgical technology to process chalcopyrite concentrate at its Niihama Research Laboratories in Niihama City, Ehime Prefecture, and that its viability had been confirmed through continuous testing at a pilot plant. In the past, chalcopyrite ore, which could not be processed by heap leaching nor solvent extraction and electrowinning, normally was processed by a pyrometallurgical refining method, which converted chalcopyrite ore to concentrate by flotation and then processed it by pyrometallurgical refining. SMM's newly developed hydrometallurgical copper refining process uses SMM's own chlorine refining technology for matt chorine leach electrowinning (MCLE), which was originally developed by SMM for its nickel refining. This technology not only helps in the processing of chalcopyrite copper concentrate by significantly improving reaction efficiency but also is cost effective and makes it possible to process a wider array of copper ores to recover iron as metal, and to effectively recover precious metals (Sumitomo Metal Mining Co. Ltd., 2005g§).

On December 26, 2005, Mitsui Mining and Smelting Co. Ltd. and Nippon Mining & Metal Co. Ltd. jointly announced that Nippon Mining & Metals would spin off its copper refining operations in Saganoseki, Oita Prefecture, and in Hitachi, Ibaraki Prefecture, to Pan Pacific Copper Co. Ltd. and that Mitsui Mining and Smelting also would transfer its copper refining operation in Tamano, Okayama Prefecture, to Pan Pacific Copper. As a result, Pan Pacific Copper would have a combined refining capacity of 678,000 t/yr of refined copper beginning in 2006. Pan Pacific Copper was established in 2001 by Nippon Mining & Metals (66%) and Mitsui Mining and Smelting (34%) to sell refined copper. In 2002, the two companies announced that they would fully integrate their copper businesses by strengthening the collaboration of their copper smelting and refining operations to promote timely response to the changing business environment and to strengthen their international competitiveness. By December 2005, Pan Pacific Copper was procuring copper ore and concentrate from overseas and was consigning refining to its parent companies for sale (Metals Place, 2005d§; Nippon Mining & Metals Co. Ltd., 2005§).

In December 2005, Dowa Mining Co. Ltd. and Mitsubishi Materials Corp. announced in their press releases that they would invest about $80 million (¥8.1 billion) to build a new furnace at the companies' joint-venture copper smelter—Onahama Smelting and Refining Co. Ltd., which was located in Onahama, Fukushima Prefecture. The new furnace, which was expected to boost the copper ore processing capacity by 25%, was scheduled to begin operation in November 2007 (Metals Place, 2005c§).

Imports of refined copper decreased by 16% to 74,100 t and were valued at $276.6 million in 2005. The major suppliers of refined copper were Chile (46.6%), Peru (22.9%), the Republic of Korea (7.9%), Zambia (5.1%), Australia (4.7%), and Thailand (4.5%). Imports of refined lead increased sharply by 83.6% to 19,060 t and were valued at about $26.2 million. The dominant

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supplier of refined lead was China (98.6%). Imports of slab zinc (refined zinc) increased by 8.2% to 45,860 t and were valued at about $64 million. The major suppliers of zinc slab were Peru (37.3%), China (28.7%), Namibia (22.2%), Canada (6.4%), and Australia (2.2%) (Ministry of Finance, 2005b, p. 666, 677).

Demand for refined copper decreased by 2.4% to 1.2 Mt in 2005. Demand for refined copper, by sector, was 751,600 t for wire and cable, 433,500 t for brass mill products, and 14,100 t for others (Ministry of Economy, Trade and Industry, 2005c, p. 268). Exports of refined copper increased by 27.3% to 247,700 t and were valued at $910.1 million. The buyers of refined copper were Taiwan (42.4%), China (37.1%), the Republic of Korea (11.3%), the United States (2.5%), Indonesia (2.4%), Malaysia (1.5%), Thailand (1.3%), and other countries (1.5%). Exports of unrefined copper and copper anodes increased by 45.3% to 11,800 t and were valued at $48.3 million. Unrefined copper and copper anodes were exported mainly to the Republic of Korea (46.6%), Taiwan (20.1%), China (12.5%), and Hong Kong (10.5%) (Ministry of Finance, 2005a, p. 575, 576).

In 2005, the demand for refined lead decreased by 20.3% to 141,400 t, of which 107,500 t was for storage batteries; 18,600 t, for inorganic chemicals; 6,000 t, for solder; 2,500 t, for lead pipe and sheet; and 6,800 t, for other uses (Ministry of Economy, Trade and Industry, 2005c, p. 270). Exports of refined lead increased by 50% to 4,240 t and were valued at $3.7 million. The major buyers of refined lead were Hong Kong (57.2%), Indonesia (21.6%), Malaysia (12.4%), China (6.2%), and the United States (5.4%) (Ministry of Finance, 2005a, p. 589).

Demand for slab zinc decreased by 3.9% to 457,700 t, of which 218,800 t was for galvanized sheet; 74,400 t, for other galvanizing; 62,300 t, for brass mill products; 45,850 t, for die-cast alloy; 23,700 t, for inorganic chemicals; and 32,650 t, for other uses (Ministry of Economy, Trade and Industry, 2005c, p. 274). Exports of zinc slab decreased by 13% to 53,700 t and were valued at $74.5 million. The major buyers were Taiwan (40.6%), Indonesia (29.3%), Vietnam (10.8%), the Philippines (8.9%), Malaysia (2.7%), Bangladesh (2.4%), and Thailand and Cambodia (1.6% each) (Ministry of Finance, 2005a, p. 590).

Gold and Silver.—Mine production of gold was mainly by SMM from the Hishikari Mine in Kagoshima Prefecture on Kyushu Island. The company, which was working on its Honko, Sanjin, and Yamada deposits in the Hishikari mining area, produced about 185,000 t of ore that averaged 40.6 grams per metric ton (g/t) gold in 2005 (Japan Mining Industry Association, 2006, p. 134). Other small-scale gold and silver mines were the Arkesi and the Kasuga in Kagoshima Prefecture. Toyoha Mining produced most of Japan's mined silver as a byproduct of lead and zinc mining operations from the Toyoha Mine in Hokkaido Prefecture. Japan's overall mine production of gold and silver was about 8,320 kilograms (kg) and 54,100 kg, respectively (Ministry of Economy, Trade and Industry, 2005d, p. 136).

In May 2004, SMM and its partners SC and Teck Cominco Ltd. of Canada began construction of the Pogo gold mine in Alaska. The construction was going well in 2005. The total capital cost, however, had been revised twice to $357 million in October 2005 from $321 million in March 2005 as compared with the original estimate of about $280 million in 2004 owing to higher than expected equipment, steel, fuel, contractor, and labor costs in Alaska. The target date for operations to begin was March 2006. The Pogo gold mine was claimed by SMM as one of the highest quality gold deposits in the world with an estimated resource of 152 t of gold. The company estimated that gold production would total 12 t/yr, of which SMM would receive 6.12 t/yr for approximately 10 years. The Pogo joint-venture project, which is located about 145 km southeast of Fairbanks, Alaska, was owned by Sumitomo Metal Mining America Inc. (a wholly owned subsidiary of SMM), 51%; Teck Cominco, the project operator, 40%; and SC Minerals America, Inc. (a wholly owned subsidiary of SC), 9% (Sumitomo Metal Mining Co. Ltd., 2005a§, f§).

In 2005, metal production of primary gold increased by about 7%. Metal production of primary silver, however, decreased by 0.2% owing to a reduced supply of raw materials and scrap inputs from domestic sources at silver refineries. Imports of gold (ingot and powder) increased by 1.6% to 71,542 kg and were valued at $1,065 million. The major suppliers of gold ingot and powder were Switzerland (40.7%), Australia (24.9), the United States (15.3%), Uzbekistan (9.0%), Hong Kong (4.5%), Canada and Russia (1.4% each), and Belgium (1.3%). Imports of silver (ingot and powder) decreased by 24.9% to 1,288 t and were valued at $301 million. The major suppliers of silver ingots and powder were the Republic of Korea (35.3%), Mexico (20.2%), Australia (17.1%), Peru (12.6%), the United States (10.9%), and China (1.2%) (Ministry of Finance, 2005b, p. 624).

In 2005, the demand for gold, which included dental, medical, electrical, and electronic uses, industrial arts and crafts, jewelry, and private investment, increased by 2.9% to 298,000 kg from 289,600 kg in 2004. The demand for gold by end use was for dental and medical, which decreased to 20,900 kg from 21,400 kg in 2004; electrical, electronic, and communication apparatus, which increased to 100,700 kg from 86,300 kg; private hoarding, which increased to 81,000 kg from 80,500 kg; gold plating, which decreased to 20,100 kg from 23,600 kg; jewelry, which increased slightly to 20,500 kg from 20,200 kg; industrial arts and crafts, which increased to 4,800 kg from 4,700 kg; pottery and porcelain, which held steady at 1,420 kg; decorations and badges, which decreased to 1,200 kg from 1,400 kg; and other uses, which decreased to 46,700 kg from 49,300 kg (table 5). Among the end users, demand for jewelry reversed its downward trend for the first time in more than 10 years (Arumu Publishing Co. Ltd., 2006, p. 125).

Demand for silver decreased by 16.1% to 2,179 t in 2005. Demand for silver by end use was for silver nitrate used for photography, 969 t; for silver nitrate used for other purposes, 299 t; for electrical contacts, 209 t; for rolled products, 214 t; for brazing alloy (silver solder), 102 t; and for other uses, 386 t (table 5) (Ministry of Economy, Trade and Industry, 2005c, p. 288).

Exports of gold ingot and powder increased by 80.4% to 20,253 kg in 2005 and were valued at $296.1 million. The major buyers of refined gold ingot and powder were the United Kingdom (46.8%), Hong Kong (27.3%), Thailand (7.8%), the United Arab Emirates (7.4%), Singapore (5.4%), and China (2.9%). Exports of silver ingot and powder increased by 72.1%

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to 1,119.4 t in 2005 and were valued at $72 million. The major buyers of refined silver and powder were India (21.9%), China (19.8%), Singapore (11.6%), Taiwan (10.3%), the Republic of Korea (9.6%), the United States (8.0%), Hong Kong (6.1%), the United Kingdom (4.5%), and Denmark (3.1%) (Ministry of Finance, 2005a, p. 497).

Iron and Steel.—Japan relied on imports to meet all the iron ore requirements of its iron and steel industry. In 2005, imports of iron ore decreased by 1.9% to 132.3 Mt and were valued at $5.59 billion. The average cost, insurance, and freight (c.i.f.) import price of iron ore was $42.23 per metric ton compared with $29.56 per ton in 2004. The major suppliers of iron ore were Australia (61.5%), Brazil (20.9%), India (7.9%), South Africa (4.0%), and the Philippines (2.8%). Imports of pig iron increased by 73.5% to 1,038,981 t and were valued at $324.57 million. The average c.i.f. import price of pig iron was $312.33 per ton compared with $291.86 per ton in 2004. The major suppliers of pig iron were China (81.6%), Taiwan (6.6%), Brazil (5.5%), North Korea (3.1%), South Africa (1.6%), and Russia (1.3%) (Ministry of Finance, 2005b, p. 170, 630).

In securing the long-term supply of iron ore, Companhia Vale do Rio Doce (CVRD) of Brazil and Nippon Steel Corp. reached an agreement in February 2005 to increase the free-on-board (f.o.b.) prices of Carajas and Itabira fine ore by 71.5% for fiscal year 2005 (April 1, 2005, to March 31, 2006). The price per metric ton of Carajas fine ore (66.5% iron) for fiscal year 2005 was $37.36 compared with $21.79 for fiscal year 2004, and for Itabira fine ore, $36.80 compared with $21.46 for fiscal year 2004 (Nippon Steel Corp., 2005b§).

In December 2005, Nippon Steel signed four separate long-term iron ore purchase agreements with four major iron ore suppliers. These included a 10-year iron ore purchase agreement with Hamersley Iron, which was an Australian iron ore company of the Rio Tinto Group, for Nippon Steel to purchase an additional 2 Mt/yr of Yandi fine ore and 2 Mt/yr of high-phosphorus Brockman ore; an agreement to revise the existing (previous) agreement between Robe River Iron Associates and an Australian iron ore joint venture made up of Mitsui & Co. Ltd., Nippon Steel, the Rio Tinto Group, and Sumitomo Metal Industries, Ltd., for the joint venture to take deliveries of 7.5 Mt/yr of Robe ore and 3.5 Mt/yr of West Angelas ore; an agreement with BHP Billiton to revise the long-term agreement for Nippon Steel to purchase 2 Mt/yr of Yandi fine ore and 2 Mt/yr of Newman ore for 7 years beginning in April 2006; and another long-term agreement with CVRD for Nippon Steel to purchase an additional 1 Mt/yr of iron ore for 5 years and 2 Mt/yr of iron ore for 10 years from Itaguai Port beginning in April 2006 (Nippon Steel Corp., 2005a§).

In July 2005, JFE Steel Corp. signed a final agreement with BHP Billiton Ltd. of Australia, Itochu Corp., and Mitsui & Co. to establish a joint venture to mine iron ore at the Yandi Western 4 (W4) Mine in the Pilbara region of Western Australia. Following the establishment of the joint venture in July 2005, an 11-year long-term iron ore purchase contract was expected to go into effect as soon as permission was granted by the Australian Government. Under the terms of the agreement, the joint venture at W4 Mine would be owned by BHP Billiton (68%), JFE Steel (20%), Itochu (6.4%), and Mitsui & Co. (5.6%). Economically exploitable reserves in the W4 mining area were estimated to be 115 Mt, and maximum iron ore production from the W4 was expected to be 15 Mt/yr for an estimated 11 years. Under the terms of the long-term iron ore purchase contract, JFE Steel would purchase 16 Mt/yr of iron ore, which was equivalent to one-third of JFE's annual iron ore requirements, from the W4 Mine for 11 years. BHP Billiton's W4 Mine produced about 40 Mt/yr of iron ore with estimated minable reserves of about 1 billion metric tons (JFE Steel Corp., 2005c§).

In 2005, pig iron production increased by 0.1% to about 83.1 Mt, of which 82.4 Mt was for steelmaking, and 621,300 t, for foundry. The iron manufacturing capacity, however, increased to 83.4 Mt/yr from 82.0 Mt/yr in 2004. The number of furnaces for iron manufacturing increased to 30 from 29. The number of blast furnaces remained unchanged at 28, and other furnaces increased to 2 from 1 in 2004 (Ministry of Economy, Trade and Industry, 2005c, p. 32, 107).

Crude steel production decreased by 0.2% to 112.5 Mt, of which 74.4% was processed by basic oxygen furnaces (LD converters), and 25.6%, by electric furnaces. The steel manufacturing total capacity increased to 124.1 Mt/yr from 120.8 Mt/yr in 2004. The number of furnaces for steel manufacturing decreased to 412 from 415 in 2004. The number of basic oxygen furnaces (LD converters) increased to 63 compared with 62 in 2004, and the manufacturing capacity of the LD converters increased to 84.2 Mt/yr from 81.4 Mt/yr in 2004. The number of electric arc furnaces decreased to 349 from 353 in 2004 and the manufacturing capacity of electric arc furnaces increased to 40 Mt/yr from 39.4 Mt/yr in 2004 (Ministry of Economy, Trade and Industry, 2005c, p. 44, 107).

In 2005, Japan was the world's second ranked producer of crude steel after China and accounted for 9.9% of the world total. Among Japan's top four steelmakers in 2005, Nippon Steel, which produced 32 Mt of crude steel, was the third ranked steel-producing company in the world after Mittal Steel Co. of the Netherlands and Arcelor S.A. of Luxembourg; JFE Steel, which produced 29.9 Mt, ranked fifth; Sumitomo Metal Industries, Ltd., which produced 13.5 Mt, ranked 16th; and Kobe Steel Ltd., which produced 7.7 Mt, ranked 32d (International Iron and Steel Institute, 2006§).

In January 2005, Nippon Steel and Sumitomo Metal Industries began to study the potential joint use of iron- and steelmaking facilities at Sumitomo Metal Industries' Wakayama Works to secure and improve their supply capabilities to meet the growing demand for steel in the domestic and overseas markets. To enhance further cooperation, Kobe Steel reportedly also participated in the study. The three companies had been implementing various cooperative measures, such as mutual cooperation in the purchase of raw materials and machinery, in the management of all nearby steel works, and in the supply of semifinished and downstream products during relining of blast furnaces, as well as joint operations in stainless steel and welding materials and supplied semifinished products (Nippon Steel Corporation, 2005b§, c§).

In June 2005, JFE Steel signed an agreement with ThyssenKrupp Stahl AG of Germany to establish a joint venture to enable vendor involvement with the global automaker. In December 2005, Hyundai HSCO of the Republic of Korea

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renewed its comprehensive collaboration agreement with JFE Steel to ensure stable supplies of high-quality automotive steel sheets for the Republic of Korea's automakers (JFE Steel Corp., 2005b§, e§)

In 2005, domestic demand for steel, as measured by domestic orders for ordinary and specialty steel products, increased by only 0.7% to about 67.9 Mt, of which 54.7 Mt was ordinary steel products and 13.2 Mt, specialty steel products. The increase in overall domestic demand for steel in 2005 was mainly the result of a 6.2% increase in demand by the manufacturers of automobiles and a 12.9% increase in demand by the manufacturers of shipbuilding and marine equipment. The increased domestic demand by the manufacturers of automobiles and shipbuilding and marine equipment offset the decreased domestic demand by the manufacturers of electric machinery and equipment, home and office appliances, and tanks and containers (table 6).

Exports of iron and steel decreased by 7.6% to 32.6 Mt in 2005 but the earnings from exports of iron and steel increased by 18.5% to $29.6 billion from $25.3 billion in 2004 because of higher export unit prices. Of the total amount of iron and steel products exported, exports to China accounted for 17.7% compared with 19.5% in 2004; to the Republic of Korea, 23.7% compared with 25.4% in 2004; to Taiwan, 11.1% compared with 9.2%; to Thailand, 12.6% compared with 11.0% in 2004; and to the United States, 4.4% compared with 4.0% in 2004. In terms of export volume, the Republic of Korea remained the leading market for Japan's iron and steel exports. Thailand was the only country to which Japan's exports of iron and steel continuously increased in the past 5 years (table 7). Of the total exports of iron and steel in 2005, 23.04 Mt was ordinary steel products; 4.59 Mt, specialty steel products; 4.07 Mt, steel ingots and semifinished products; 0.60 Mt, secondary products; 33,568 t, pig iron; and 221,978 t, others (ferroalloys, clad plate, and cast-iron pipes) (Japan Iron and Steel Federation, 2006§).

In 2005, imports of iron and steel products increased by 19.7% to 8.4 Mt owing mainly to a 22.5% increase in imports of ordinary steel products; the import bill for iron and steel increased by 8.2% to $7.63 billion from $7.05 billion in 2004. Of the total imports, 4.2 Mt was ordinary steel products; about 3.2 Mt was pig iron, ferroalloys, steel ingot, and semimanufactured steel; 569,886 t was secondary steel wire and other secondary steel products; and 294,100 t was specialty steel products. Of the ordinary steel products imported, imports of hot-rolled wide strip increased by 73.9% to 1.6 Mt and those of cold-rolled sheet and strip, by 54.1% to 1.1 Mt. Imports of specialty steel products decreased by 0.7% to 294,100 t. The major suppliers of ordinary steel products were the Republic of Korea (55.9%), Taiwan (21.1%), and China (19.5%) in 2005 (Japan Iron and Steel Federation, 2006§).

Manganese.—Japan relied on imports to meet all its manganese raw material requirements for the iron and steel and EMD industries. In 2005, Japan imported 1.2 Mt of high-grade manganese ore, 97,721 t of ferruginous manganiferous ore, 28,636 t of low-grade manganese ore, and 1,489 t of high-grade manganese dioxide ore. The major suppliers of high-grade manganese ore were South Africa (64.7%) and Australia (31.9%). The major suppliers of ferruginous manganiferous ore were South Africa (59.3%) and India (39.6%). Ghana supplied 99.9% of Japan's low-grade manganese ore imports, and Gabon supplied 94% of Japan's high-grade manganese dioxide ore imports for the year. The import bill for manganese ores totaled $220.9 million (Ministry of Finance, 2005b, p. 170).

Production of ferromanganese increased by 2.6% to 448,600 t in 2005 (Ministry of Economy, Trade and Industry, 2005c, p. 34). Imports of ferromanganese increased by 20.7% to 61,800 t. The major suppliers were Australia (31.7%), South Africa (31.4%), China (24.0%), India (6.4%), and the Republic of Korea (4.7%). Japanese imports of ferrosilicomanganese decreased by 22.0% to 234,400 t. The principal suppliers were China (57.2%), Ukraine (17.70%), the Republic of Korea (5.5%), Australia (5.3%), and Kazakhstan (4.8%). The imports bill for ferromanganese and ferrosilicomanganese totaled $183.7 million (Ministry of Finance, 2005b, p. 630).

Consumption of high- and low-carbon ferromanganese for steel manufacturing increased by 5.6% to 419,000 t, of which 358,000 t was high-carbon ferromanganese and 61,000 t, low-carbon ferromanganese (Ministry of Economy, Trade and Industry, 2005c, p. 216). In 2005, consumption of ferrosilicomanganese increased by 3.2% to 305,000 t and exports of ferromanganese decreased by 2.5% to 9,600 t. The major buyers were the United States (34.2%), Taiwan (26.4%), Malaysia (14.5%), and Thailand (11.6%). Export earnings from ferromanganese totaled $13.1 million (Ministry of Finance, 2005a, p. 501).

In 2005, Japan was the world's second ranked producer of EMD after China. Japan's EMD producers were Mitsui Mining & Smelting, which operated the Takehara plant (24,000 t/yr) in Hiroshima Prefecture, and Tosoh Corp., which operated the Hyuga plant (34,000 t/yr) in Miyazaki Prefecture and the Thessaloniki (Salonita) plant (19,000 t/yr) in Greece. Japan Metals & Chemical Co. Ltd., which operated the Takaoka plant (18,000 t/yr) in Toyama Prefecture, stopped EMD production in 2002. In 2005, Japan produced about 45,500 t of EMD, about 17,000 t of which was consumed domestically for the production of batteries. Imports of EMD increased by 92% to 13,400 t and were valued at $16.3 million. South Africa, Australia, and China were the three principal suppliers and accounted for 36.8%, 31.8%, and 27.1% of Japanese EMD imports, respectively. Exports of EMD totaled 29,086 t and were valued at $36.9 million. The major buyers were Indonesia (33.1%), Singapore (23.8%), the United States (17.0%), China (9.0%), and the Republic of Korea (7.1%) (Ministry of Finance, 2005a, p. 114-115; 2005b, p. 182; Arumu Publishing Co. Ltd., 2006, p. 44-45).

Nickel.—Japan was the world's leading importer and consumer of nickel, but relied on imports to meet all its nickel raw material requirements in 2005. It was the world's second ranked producer of nickel metal after Russia (World Bureau of Metal Statistics, 2006, p. 104). Nickel ores and nickel mattes were imported for the production of ferronickel, nickel chemicals (salts), nickel oxide and powder, and refined nickel. Additionally, ferronickel, nickel powder and flake, nickel oxide sinter, nickel waste and scrap, and refined nickel were imported to meet the nickel requirements of the battery, catalysts, magnetic materials, nonferrous alloys, plating, and specialty steel industries, and other end users.

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In 2005, imports of nickel ore increased by 5.5% to 4.75 Mt and were valued at $345.1 million. The suppliers of nickel ore were Indonesia (46.6%), the Philippines (29.0%), and New Caledonia (24.4%). Imported nickel ore from Indonesia contained 35,500 t of nickel; the Philippines, 23,200 t of nickel; and New Caledonia, 21,700 t of nickel. Imports of nickel mattes, in gross weight, decreased by 16.4% to 106,400 t and were valued at $983.7 million. The suppliers of nickel matte were Indonesia (88.6%) and Australia (11.4%). Imported nickel mattes from Indonesia contained 70,700 t of nickel, and Australia, 9,100 t (Ministry of Finance, 2005a, p. 170, 671; Japan Mining Industry Association, 2006, p. 108).

Imports of ferronickel, in gross weight, decreased by 13.2% to 48,200 t and were valued at $204.2 million. The suppliers of ferronickel were New Caledonia (66.4%), Colombia (17.6%), the Dominican Republic (10.8%), and Indonesia (4.8%). Imported ferronickel from New Caledonia contained 8,970 t of nickel; Colombia, 3,400 t of nickel; the Dominican Republic, 2,030 t; and Indonesia, 460 t. Imports of refined nickel decreased by 4.3% to 49,700 t and were valued at $751.5 million. The major suppliers of refined nickel were Norway (15.2%), Russia (14.4%), South Africa (14.2%), China (13.6%), Brazil (12.3%), Zimbabwe (8.9%), Australia (7.9%), Canada (6.3%), and the United Kingdom (4.7%). Imports of nickel oxide sinter, in gross weight, decreased by 39.0% to 763 t and were valued at $9.2 million; Australia and Cuba were the two dominant suppliers of nickel oxide and accounted for 66.5% and 30.2%, respectively. Imports of nickel powders and flakes decreased by 53.4% to 4,380 t and were valued at $69.0 million. The major suppliers of nickel powders and flakes were Canada (85.3%), Russia (6.5%), and the United Kingdom (6.4%). Imports of nickel waste and scrap decreased by 25.0% to 7,050 t and were valued at $77.1 million. The major suppliers of nickel waste and scrap were the United States (25.9%), Russia (18.8%), the Republic of Korea (17.4%), and Taiwan (9.1%) (Ministry of Finance, 2005b, p. 630, 671).

To secure processed nickel products overseas to extend their nickel processing businesses in Japan, SMM and SC participated in major nickel development projects in New Caledonia and Madagascar in 2005. In August 2005, SC agreed to join Dynatec Corp. (75%) of Canada in the Ambatovy nickel laterite development project, which is located about 80 km east of Antananarivo—the capital city of Madagascar—by taking a 25% interest in the project. Under the agreement, SC would provide 25% of the equity portion of the project's capital cost and a proportional share of the project's debt guarantees. SC also would provide Dynatec with a subordinated loan to help fund Dynatec's equity contribution to the capital cost. SC had committed to find a market for at least 30,000 t/yr of nickel during the first 15 years of production. According to Dyantec's 2005 feasibility study of Ambatovy, the nickel mine could produce 60,000 t/yr of nickel and 5,600 t/yr of cobalt. The average cash operating costs for the first 10 years were estimated to be $0.67 per pound of nickel. The capital costs were estimated to be $2.25 billion. The mine construction was expected to begin in June 2006, and the production of nickel was scheduled to begin in 2008 (Mining Journal, 2005c).

SMM and Mitsui & Co. Ltd., through Sumic Nickel Netherlands, which was a joint venture of SMM (52.38%) and Mitsui & Co. (47.62%), signed an agreement with Inco Ltd. of Canada to acquire a 21% equity interest in Goro Nickel S.A. for $150 million in April 2005. Inco's Goro nickel-cobalt project, which is located in New Caledonia, is owned by Inco (69%); Sumic Nickel Netherlands (21%); and three provinces of New Caledonia (10%). The Goro nickel-cobalt project, which will use hydrometallurgical process technology, was scheduled to produce about 60,000 t/yr of nickel in nickel oxide and between 4,000 and 5,000 t/yr of cobalt in cobalt carbonate by mining and treating about 4 Mt/yr of ore starting in the fall of 2007. Under the agreement, Sumic Nickel Netherlands was obligated to provide its share of the financing required to complete the project and to buy its share of the nickel and cobalt produced from Goro (Mining Journal, 2005a; Mining News, The, 2005§; Sumitomo Metal Mining Co. Ltd., 2005a§).

In August 2005, SMM reportedly had shown interest in pursuing exploration of nickel and cobalt on Santa Isabel in the Solomon Islands. According to the Ministry of Mines and Energy of Solomon Islands, the Department of Mines had issued SMM a Letter of Intent before issuing a prospecting license (Metals Place, 2005a§).

In 2005, production of ferronickel, in gross weight, increased by 4.5% to about 391,100 t; the ferronickel contained about 76,400 t of nickel. Ferronickel producers were Pacific Metals Co. Ltd. in Hachinohe, Aomori Prefecture, which produced 41,621 t of nickel; SMM in Hyuga, Miyazaki Prefecture, 22,638 t of nickel; and YAKIN Oheyama Co. Ltd. at Oheyama near Miyazu, Kyoto Prefecture, 12,131 t of nickel (Arumu Publishing Co. Ltd., 2006, p. 80).

Consumption of ferronickel for steel manufacturing, in gross weight, decreased by 10.4% to 281,300 t in 2005 (Ministry of Economy, Trade and Industry, 2005c, p. 216). Exports of ferronickel increased by 13.2% to 125,600 t and were valued at $321.6 million, 48.4% of which went to the Republic of Korea; 41.9%, to Taiwan; and 9.7%, to China (Ministry of Finance, 2005a, p. 501).

Refined nickel was produced solely by SMM at its nickel refinery in Niihama, Ehime Prefecture. The 36,000-t/yr refinery used its own matte chlorine leaching electrowinning (MCLE) technology to process imported nickel matte from Australia and Indonesia to produce refined nickel and nickel salts for domestic consumption and export. Tokyo Nickel Co. Ltd. operated a 60,000-t/yr smelter in Matsuzaka, Mie Prefecture, which also used imported nickel matte to produce briquettes, granules, and nickel oxide sinters for domestic consumption and export.

In April 2005, SMM began commercial operation of a processing plant at Rio Tuba in the southern part of Palawan Island in the Philippines (Coral Bay Nickel Project) to produce nickel-cobalt-mixed sulfide from low-grade nickel oxide lateritic ore. According to SMM, the high-pressure acid leach (HPAL) method of processing low-grade nickel oxide ore was implemented successfully at the Coral Bay project after construction of the plant was completed in August 2004. The project called for the plant to process the 16 Mt of nickel oxide ores and low-grade laterite (limonite), which were mined and stockpiled at the Rio Tuba mine site, by using HPAL to produce

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about 10,000 t of nickel and 700 t of cobalt in nickel/cobalt mixed sulfide that was to be delivered to SMM's Niihama Nickel Refinery for the production of electrolytic nickel and electrolytic cobalt using its own MCLE process technology. The Coral Bay Nickel Project was owned by SMM (54%), Mitsui & Co. and Sojitz Corporation (18% each), and Rio Tuba Nickel Mining Corporation (10%) (Sumitomo Metal Mining Co. Ltd., 2005a§, b§).

In 2005, the domestic demand for refined nickel decreased by 15.3% to 58,000 t owing mainly to the sharp decline in demand by the manufacturers of specialty steel, batteries, and magnetic steel and catalysts. The domestic demand for refined nickel by the manufacturers of specialty steel decreased by 16.6% to 46,200 t; batteries, by 31.4% to 3,100 t; magnetic steel, by 17.0% to 1,900 t; and catalysts, by 9.5% to 440 t. Demand for refined nickel by the manufacturers of galvanizing sheet increased by 13.7% to 3,280 t, and by other end users, by 5.2% to 3,200 t (Ministry of Economy, Trade and Industry, 2005c, p. 280).

In 2005, exports of refined nickel increased sharply by 650.2% to 1,673 t from 223 t in 2004. Export earnings from refined nickel were valued at $22.9 million compared with $3.7 million in 2004. The major buyers of refined nickel were China (64.8%), Hong Kong (27.5%), Indonesia (3.4%), and Thailand (2.6%). Exports of nickel oxide sinter and other intermediate products of nickel metallurgy increased by 5.6% to 34,550 t and were valued at $435.5 million. The principal buyers were the Republic of Korea (52.4%) and Taiwan (45.6%). Exports of nickel powders and flakes increased by 8.4% to 1,810 t and were valued at $48.1 million. The major buyers were China (58.2%), Hong Kong (18.5%), the Republic of Korea (7.1%), and the United States (5.7%). Exports of nickel waste and scrap increased by 181.2% to 1,125 t and were valued at $9.8 million. The major buyers were the United Kingdom (46.3%), the United States (28.4%), and Vietnam (9.3%) (Ministry of Finance, 2005a, p. 582-583).

Titanium.—In 2005, Japan replaced Russia as the world's first ranked producer of titanium sponge metal and accounted for 30.2% of the world total (Arumu Publishing Co. Ltd., 2006, p. 67). Japan also was one of the world's major producers of titanium dioxide pigment. Japan imported its raw material requirements for the production of titanium sponge metal and titanium dioxide pigment mainly from Australia, India, and Vietnam. Titanium ore (rutile) was consumed by the producers of titanium sponge metal. Ilmenite and titanium slag were consumed by the manufacturers of synthetic rutile and titanium dioxide pigment.

In 2005, imports of titanium ore (rutile) increased by 41.0% to 126,930 t and were valued at $64.8 million. The major suppliers were Australia (51.8%), India (33.9%), Canada (7.3%), and South Africa (6.4%). Imports of ilmenite increased by 6.3% to 382,900 t and were valued at $43.9 million. The major suppliers were Vietnam (40.8%), Australia (21.5%), Egypt (14.2%), Canada (11.6%), India (6.0%), and Malaysia (5.8%) (Ministry of Finance, 2005b, p. 171).

According to the estimate by Advanced Materials Japan Corporation, production of titanium sponge increased by 31.9% to 31,000 t because of the stronger demand in the domestic and overseas markets, especially the U.S. market. According to the statistics published by the Japan Titanium Society and the Ministry of Finance, total titanium sponge shipments increased by 16.5% to 30,550 t in 2005; shipments of titanium sponge to the domestic market increased by 18.5% to 21,350 t; exports of titanium sponge increased by 12.0% to 9,200 t; and imports of titanium metal powder decreased by 34.5% to 3,930 t. Exports of titanium sponge went mainly to the United States (67.9%) and the United Kingdom (23.1%). Imports of titanium metal powder were mainly from Kazakhstan (37.0%), Russia (29.0%), and the United States (18.5%). Shipments of titanium mill products increased by 25.6% to 17,400 t; domestic shipments of titanium mill products increased by 17.6% to 10,100 t, and exports of titanium mill products decreased by 5.5% to 8,100 t (Arumu Publishing Co. Ltd., 2006, p. 66-70).

To meet the rising worldwide demand for titanium sponge metal, Toho Titanium Co. Ltd. raised its sponge production capacity to 15,000 t/yr in October 2005 from 13,000 t/yr. Toho planned to expand its capacity to 15,700 t/yr in August 2007 and, ultimately, to 22,000 t/yr in 2011. In February, Sumitomo Titanium Corp. announced that it planned to raise its sponge production capacity to 24,000 t/yr from 18,000 t/yr in two stages at a total cost of about $57 million. The capacity would be raised to 22,000 t/yr in September 2005 during the first stage of expansion at a cost of $43 million and, in the second stage, to 24,000 t/yr in March 2006 at a cost of $14 million (Arumu Publishing Co. Ltd., 2006, p. 66).

Production of titanium dioxide increased by 2.2% to 259,000 t in 2005 owing mainly to a stronger domestic demand by the manufacturers of paints and coating material, printing inks and pigments, and synthetic resin (plastics). Shipments of titanium dioxide totaled about 251,600 t, of which domestic shipments were 168,300 t, and exports, 83,340 t. Japan's domestic shipments of titanium dioxide by end-use were paints and coating materials (45.5%), printing inks and pigments (21.8%), synthetic resin (plastics) (10.9%), paper (8.6%), chemical fibers (1.4%), rubbers (1.3%), condensers (0.9%), and others (9.7%) (Ministry of Economy, Trade and Industry, 2005b, p. 57; Roskill's Letters from Japan, 2006b).

Imports of titanium oxide decreased by 13.9% to 13,100 t and were valued at $19.7 million. The major suppliers were China (49.2%), the Republic of Korea (33.0%), France (5.2%), Germany (4.1%), and Malaysia (3.8%) in 2005 (Ministry of Finance, 2005b, p. 183). Exports of titanium oxide decreased by 15.4% to 26,300 t and were valued at $77.5 million. The major buyers were China (36.0%), Taiwan (27.4%), the Republic of Korea (8.5%), Indonesia (5.8%), the United States (4.1%), and Thailand (3.8%) (Ministry of Finance, 2005a, p. 115).

Industrial Minerals

Cement.—In 2005, Japan was the world's fourth ranked cement producer and consumer after China, India, and the United States. As of October 2005, the cement industry comprised 18 companies, 32 cement plants, and 58 kilns concentrated in the areas of Chugoku and Kyushu, where most of Japan's limestone resources and limestone quarries are located (Japan Cement Association, 2006§). The cement

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industry's total clinker capacity remained unchanged from that of 2004 at 76 Mt/yr; the total number of regular employees, however, declined to 3,313 from 3,349 in 2004. Production of cement clinker increased to 66.7 Mt from 65.4 Mt in 2004 and production of cement increased to 69.6 Mt from 67.4 Mt in 2004. Of the total cement produced in 2005, portland cement accounted for 76.5%; portland blast-furnace cement, 22.3%; and fly ash cement and other cement, 1.2%. The cement industry consumed 76.1 Mt of limestone, 10.2 Mt of clay, 5.6 Mt of silica stone, 5.3 Mt of blast furnace ore slag, and 2.6 Mt of gypsum. Total shipments of cement increased by 2.9% to 68.8 Mt (Ministry of Economy, Trade and Industry, 2005a, p. 70-73, 123, 127, 130).

According to Japan Cement Association, Japan's apparent cement consumption increased by 1.8% to 59.0 Mt and its apparent cement consumption per capita increased to 462 kg from 454 kg in 2004. Japan's per capita cement consumption, which peaked at 697 kg in 1991 and then started its downward trend to a low point of 454 kg in 2004, rebounded to 462 kg in 2005 (Japan Cement Association, 2006§). Exports of cement clinker decreased by 18.0% to 4.05 Mt and were valued at $91.6 million; those of portland cement increased by 14.1% to 6.09 Mt and were valued at $143.5 million. The major buyers of cement clinker were Hong Kong (25.0%), Australia (18.0%), Malaysia (10.0%), Benin (9.0%), China (7.1%), and Brunei (5.6%). The major buyers of portland cement were the Republic of Korea (24.7%), Singapore (19.8%), China (13.6%), Hong Kong (12.2%), Nigeria (12.0%), Kuwait (6.1%), Taiwan (5.2%), and the United Arab Emirates (2.8%). The average export f.o.b. price of portland cement increased to $23.56 per metric ton from $21.77 per metric ton in 2004 (Ministry of Finance, 2005a, p. 102). In 2005, Japan imported only 1,362 t of cement clinker mainly from China (88.1%) and France (11.7%). Imports of portland cement increased by 11.9% to 912,800 t. The Republic of Korea was the dominant supplier and accounted for 94.9%. The average import c.i.f. price of portland cement increased to $39.52 per metric ton in 2005 from $39.01 per metric ton in 2004 (Ministry of Finance, 2005b, p. 169).

Limestone.—Japan was one of the world's leading limestone producers. In 2005, limestone production increased by 2.1% to 165.2 Mt. Domestic demand increased by 2.0% to 156.6 Mt. The stronger demand for limestone in the domestic market was boosted by increased demand for the production of cement, ferroalloys, and steel in the manufacturing sector and for concrete aggregate in the construction sector. Domestic limestone demand by end use was cement (41.7%), concrete aggregate and refractory materials (22.2%, each), ferroalloys and steel smelting (15.3%), roads (4.9%), and refractories, soda, glass and other uses (15.9%) (Ministry of Economy, Trade and Industry, 2005d, p. 140-141).

Japan was a net exporter of limestone in 2005. To meet certain domestic limestone requirements, however, Japan's imports of limestone flux, limestone, and other calcareous stone totaled 293,900 t and were valued at $12.2 million. The major suppliers were Vietnam (45.9%), Malaysia (33.3%), China (12.9%), and the Philippines (7.1%). Exports of limestone flux, limestone, and other calcareous stone totaled 3.32 Mt and were valued at $25.3 million. The major buyers were Taiwan (55.5%), the Republic of Korea (25.6%), and Australia (16.8%) (Ministry of Finance, 2005a, p. 101; b, p. 169).

Mineral Fuels

Coal.—Japan relied on imports to meet all its annual requirements for coking coal and anthracite mainly for the iron and steel industry, and to meet about 99% of its annual requirements for steam (thermal) coal mainly for the cement, chemical, electric power, and paper and pulp industries. Japan produced a small quantity of steam coal from about eight coal mines, all of which were located in Hokkaido Prefecture for consumption by the local power generation plants.

In 2005, coal was produced mainly by an underground mine operated by Kushiro Coal Mine Co. Ltd., and seven small-scale open pit mines in Hokkaido Prefecture. The Kushiro Mine, which was a center for transferring Japanese coal technology to large-scale coal-producing countries in Asia, produced about 700,000 t, and the remaining seven small-scale coal mining companies produced a total of about 450,000 t (Japan Coal Energy Center, 2005).

In 2005, Japan's overall coal imports increased by only 0.5% to 180.8 Mt, which was valued at $13.73 billion; of the total imports, 96.17 Mt was bituminous coal (steam other than coking coal), which was valued at $5.95 billion; 78.75 Mt was coking coal, which was valued at $7.25 billion; and 5.9 Mt was anthracite, which was valued at $528 million. The major suppliers of coking coal were Australia (55.5%), Indonesia (21.10%), Canada (8.4%), China (7.2%), Russia (4.2%), and the United States (2.6%); the major suppliers of bituminous coal (steam coal) were Australia (62.0%), China (17.0%), Indonesia (13.2%), and Russia (6.9%); and the major suppliers of anthracite were Vietnam (39.9%), China (33.4%), Russia (13.9%), Australia (7.4%), and North Korea (4.7%) (Ministry of Finance, 2005b, p. 172).

To secure a long-term stable supply of coking coal, JFE Shoji Trade Corp. and JFE Steel announced in June 2005 that they had each acquired a 2.5% interest in two coking coal mines in Australia owned by American Metals & Coal International, Inc. According to JFE Steel, the two coking coal mines were Caborough Downs Coal Mine, which is an underground coal mine that is located in the State of Queensland, and Glennies Creek Coal Mine, which is an underground coal mine that is located in the State of New South Wales. Caborough Downs and Glennies Creek each would supply a total of 6 Mt to JFE Steel and JFE Shoji Trade during a 10-year period beginning in 2006. In October 2005, JFE Steel announced that it had reached a basic agreement with Elk Valley Coal Corp. of Canada for a long-term coking coal purchase contract. Under the contract, JFE Steel would purchase 2.5 Mt/yr of hard coking coal for a 10-year period beginning in 2006 (JFE Steel Corp., 2005a§, d§).

Natural Gas and Petroleum.—Japan was one of the world's leading consumers and importers of natural gas and crude petroleum. Domestic production of natural gas and crude petroleum was insignificant because of the country's limited indigenous oil and gas reserves. Japan's natural gas and crude petroleum reserves were estimated to be 39.6 billion cubic

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meters and 58.5 million barrels (Mbbl), respectively (Oil & Gas Journal, 2005).

In June 2005, Japan Petroleum Exploration Company (Japex) announced that it had discovered natural gas and oil in a field that is located about 4 km offshore near the town of Nakajo in Niigata Prefecture. According to Japex Offshore Ltd., which was a subsidiary of Japex, the joint appraisal drilling with Mitsubishi Gas Chemical Company produced about 60,000 cubic meters of natural gas and 200 barrels per day (bbl/d) of oil. The field reportedly was 80% owned by Japex and 20% owned by Mitsubishi Gas (Rigzone.com, 2005§).

In 2005, domestic production of natural gas increased by 8.2% to 3.12 billion cubic meters, of which about 98.8% was produced from gasfields mainly in the Prefectures of Niigata (64.4%) and Hokkaido (12.8%); and 1.2%, from oilfields mainly in Akita Prefecture. Crude petroleum production increased by 10.0% to 5.77 Mbbl. Japan relied on imports to meet all its annual natural gas and crude oil requirements for its power generating and oil refining industries. In 2005, Japan imported 76.2 billion cubic meters (50.91 Mt) of natural gas in the form of LNG. However, according to the Ministry of Finance's Trade statistics, imports of LNG totaled 58.01 Mt (86.84 billion cubic meters) and were valued at $18.02 billion. The major suppliers of LNG were Indonesia (24.6%), Malaysia (23.4%), Australia (17.5%), Qatar (10.9%), Brunei (10.8%), the United Arab Emirates (8.8%), and the United States (2.2%) (Ministry of Economy, Trade and Industry, 2005d, p. 22-23, 26-28, 106-107; Ministry of Finance, 2005b, p. 178).

Crude petroleum imports of 1.54 billion barrels (Gbbl) were mainly from the Middle East (90.2%) and Southeast Asia (4.5%). The major suppliers of crude petroleum were Saudi Arabia (29.0%), the United Arab Emirates (24.5%), Iran (13.8%), Qatar (9.6%), Kuwait (7.5%), Indonesia and Oman (2.9% each), and the Neutral Zone (of Kuwait and Saudi Arabia) (1.9%). Imports of crude petroleum were valued at $79.9 billion (Ministry of Economy, Trade and Industry, 2005d, p. 28-34; Ministry of Finance, 2005b, p. 173).

Japan's petroleum industry comprised 19 companies with a total of about 20,000 employees. The petroleum refining industry consisted of 29 operating refineries that were owned and operated by 16 oil refining companies that had a total combined refining capacity of 4.77 million barrels per day. The crude petroleum processing capacity utilization rate was 87.2% in 2005 compared with 84.4% in 2004 (Petroleum Association of Japan, 2006§, p. 9, 61).

In 2005, demand for crude petroleum (crude petroleum processed by the domestic refineries) increased by 2% to 1.51 Gbbl, of which 99.7% was imported crude petroleum. Domestic demand for refined petroleum, by product, was as follows: gasoline, 387.6 Mbbl; heavy fuel oil, 347.4 Mbbl; naphtha, 311.6 Mbbl; diesel (gas oil), 235.5 Mbbl; kerosene, 185.8 Mbbl; jet fuel, 30.9 Mbbl; asphalt, 20.9 Mbbl; lubricants, 12.9 Mbbl; and paraffin wax, 481,000 bbl. To meet its domestic demand, Japan imported 231 Mbbl of refined fuel products, which included 179.7 Mbbl of naphtha; 24.3 Mbbl of heavy fuel oil; 15.4 Mbbl of gasoline; 6.2 Mbbl of kerosene; 3.0 Mbbl of diesel; and 2.2 Mbbl of jet fuel. Other imported refined petroleum products included 155.6 Mbbl of liquefied petroleum gas, 359,600 bbl of lubricants, and 51,700 bbl of paraffin wax (Ministry of Economy, Trade and Industry, 2005d, p. 76, 86-89).

Consumption of domestically produced natural gas increased by 7.3% to 3.8 billion cubic meters, of which the gas industry (distribution for household uses) accounted for 52.1%; electric power generation, 15.2%; oil and gas industry use, 14.9%; chemicals, 12.3%; and other manufacturing and services uses, 5.6%. Of the 50.96 Mt (76.28 billion cubic meters) of imported LNG, about 70% was consumed by the electric power industry for power generation and about 30% was for household gas and industrial use (Ministry of Economy, Trade and Industry, 2005d, p. 24, 83).

At the end of 2005, Japan's stockpile of crude petroleum and partially refined and refined petroleum products amounted to a 170-day supply. This total included 91 days in the national (Government-owned) stockpile and 79 days in the private (privately owned) stockpile (Ministry of Economy, Trade and Industry, 2005d, p. 150-151).

Reserves

Japan's reserves of limestone and other industrial minerals, such as dolomite, iodine, pyrophyllite, and silica stone, are large. Coal reserves are not large and are very costly to mine. With the exception of gold, ore reserves for metallic minerals and other minerals, especially oil and gas, are negligible (table 3).

Infrastructure

Japan had one of the most modern infrastructures for its mining and mineral-processing industries in the world. Despite its small land area, Japan had a highway system of 1.18 million kilometers, of which 925,000 km was paved and 258,000 km was unpaved. The railroad network had 23,600 km, of which 16,600 was electrified. Highway and railroad networks link all major seaports and all coastal cities on the four major islands. The networks also connect Honshu to Kyushu and Shikoku Islands in the south and Hokkaido Island in the north by means of bridges and tunnels.

Japan's domestic and international telecommunication services were among the best in the world; they included land and mobile phone services; satellite earth stations [five Intelsat (four in the Pacific Ocean and one in the Indian Ocean), one Intersputnik (in the Indian Ocean), and one Inmarsat (in the Indian and the Pacific Ocean regions)]; submarine cables to China, the Philippines, Russia, and the United States (via Guam); and about 73 Internet service providers and about 12,962,000 Internet hosts. For electric power generation, Japan had 4,683 powerplants with a total capacity of about 266.1 million kilowatts. For electric power transmission, Japan had a route length of about 94,000 km and a circuit length of about 166,000 km. For power distribution, Japan's total length of line distances, which included high- and low-voltage, was about 1,255,000 km concentrated in the major industrial areas of Fukuoka, Hiroshima, Nagoya, Osaka, Takamatsu, Tokyo, and Toyama. Japan also had an extensive pipeline system that comprised 2,719 km for natural gas, about 170 km for oil, and about 60 km for oil, gas, and water.

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Japan had 27 major ports to receive raw materials from overseas and to export manufactured products. The major port facilities, which included terminals and warehouses, were among the most indispensable parts of the infrastructure for the mineral industry because of their roles in receiving imported raw materials (such as coal, crude petroleum, iron ore, LNG, nonferrous ore, and phosphate rock for mineral-processing plants and powerplants) and exporting value-added mineral and metal products. The important seaports of the major mineral-processing centers were Akita, Amagasaki, Chiba, Hachinohe, Higashi-Harima, Himeji, Hiroshima, Kawasaki, Kobe, Mizushima, Nagoya, Osaka, Sakai, Shimizu, Tokyo, and Yokohama on Honshu (Main Island); Fukuoka, Kita Kyushu, Moji, and Oita on Kyushu Island; Hakodate, Kushiro, Muroran, and Tomakomai on Hokkaido; and Sakaide on Shikoku Island.

Japan had 175 airports (145 had paved runways and 30, unpaved) in 2005. The major international airports were Fukuoka, Haneda (Tokyo), Kansai, Nagoya, Narita (New Tokyo), and Osaka. Japan's round-the-clock airport, Kansai International, sits on reclaimed offshore land in Osaka Bay.

Outlook

Japan's economy is forecasted to continue to grow at a rate 2.7% in 2006 and then to grow at a slower pace of 2.1% in 2007 (International Monetary Fund, 2006§). Domestic mining activities during the next 2 years are expected to decline in the industrial minerals sector as in the production of lead, silver, and zinc mainly because of the depleting ore reserves. Metal production of copper and zinc is expected to hold steady or to increase slightly in 2006. During the next 2 years, production of crude steel is expected to exceed 113 Mt because of the continued strong demand from the Japanese automobile and machinery and equipment sectors and because of an anticipated increase in exports to such Asian countries as Taiwan and Thailand. Production of titanium sponge metal is expected to increase considerably because of the continuing strong domestic demand and increasing orders coming from the United States. Production of cement and limestone is expected to hold steady with no further cutback in public works spending.

To sustain its economic health and to prevent another economic recession, Japan is expected to continue to export more ferrous and nonferrous metals and cement clinker and cement to China, the Republic of Korea, Southeast Asian countries, and Taiwan where the economies are expected to continue to improve in the coming years. Imports of coal, iron ore, nonferrous metals, and other minerals are expected to increase during the next 2 years as the consumption of raw materials trend upward in the iron and steel, nonferrous metals, and utility industries.

In line with its mineral policy to secure and diversify its long-term supply of raw materials, which will ensure a steady economic growth, Japan is expected to continue its active search for direct investment in joint exploration and development of minerals in developed and developing countries, especially in Australia, Canada, Chile, China, Indonesia, Mexico, Peru, the Philippines, and the United States. The targeted minerals were antimony, chromium, coal, columbium (niobium), copper, gold, iron ore, lead, lithium, manganese, molybdenum, natural gas, nickel, crude petroleum, rare earths, silver, strontium, tantalum, titanium, tungsten, vanadium, and zinc.

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TABLE I

JAPAN: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2001	2002	2003	2004	2005[p]
METALS						
Aluminum:						
Alumina	thousand metric tons	331	333	363	380 r	350 e
Aluminum hydroxide	do.	739	724	740	750 r	740 e
Metal:						
Primary:						
Regular grades	do.	7	6	6	6	7
High-purity	do.	27	40	44	55	45
Secondary[2]	do.	1,171	1,239	1,261	1,015	1,035
Antimony:						
Oxide		8,789	9,052	8,235 r	8,716	7,792
Metal		101	183	121	222	253
Arsenic, trioxide[e]		40 r	40 r	40 r	40 r	40
Bismuth		551	474	513	522	463
Cadmium, refined		2,460	2,444	2,509	2,233	2,297
Chromium, metal[e]		1,350	1,600	1,500	1,600	700
Cobalt, metal		350	354	379	421 r	471
Copper:						
Mine output, Cu content		744	--	--	--	--
Metal:						
Blister and anode:						
Primary		1,328,489	1,317,291	1,343,353	1,270,995	1,319,247
Secondary		139,764	182,069	172,724	194,927	198,516
Total		1,468,253	1,499,360	1,516,077	1,465,922	1,517,763
Refined:						
Primary		1,287,165	1,211,111	1,251,728	1,188,491	1,227,528
Secondary		138,526	189,968	178,637	191,653	167,756
Total		1,425,691	1,401,079	1,430,365	1,380,144	1,395,284
Gallium, metal:						
Primary[e]		8	8	9	9	9
Secondary		62	80	83	81	81
Germanium:						
Oxide[e]		10	20	30	50	50
Metal, polycrystal	kilograms	1,615	803	621	943	1,731
Gold:						
Mine output, Au content	do.	7,815	8,615	8,143	8,021	8,318
Metal:						
Primary	do.	155,826	144,748	161,399	136,616	146,182
Secondary[3]	do.	19,831	21,160	22,549	23,183	23,710
Total	do.	175,657	165,908	183,948	159,799	169,892
Indium, metal[e]	do.	55,000	60,000	70,000	70,000	70,000
Iron and steel:						
Iron ore and iron sand concentrate:[e]						
Gross weight		750 [4]	--	--	--	--
Fe content		258 [4]	--	--	--	--
Metal:						
Pig iron	thousand metric tons	78,836	80,979	82,091	82,974	83,058

See footnotes at end of table.

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TABLE 1--Continued
JAPAN: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2001	2002	2003	2004	2005[p]
METALS--Continued						
Iron and steel--Continued:						
Metal--Continued:						
Electric-furnace ferroalloys:						
Ferrochrome		111,167	91,937	19,427	13,472	12,367
Ferromanganese		368,293	356,717	371,831	437,389	448,616
Ferronickel		367,739	370,973	369,099	374,213	391,074
Silicomanganese		62,238	70,965	58,043	73,041	94,725
Other:						
Ferromolybdenum		3,485	2,375	2,691	3,323	4,019
Ferrotungsten		109	9	12	--	--
Ferrovanadium		3,613	3,592	3,491	2,178	2,360
Unspecified		5,733	6,376	3,813	7,321	10,057
Total		922,377	902,944	828,407	910,937	963,218
Steel, crude	thousand metric tons	102,866	107,745	110,511	112,718	112,471
Semimanufactures, hot-rolled:						
Ordinary steels	do.	78,927	80,838	81,769	83,354	80,828
Special steels	do.	15,835	17,451	18,735	19,843	20,360
Lead:						
Mine output, Pb content		4,997	5,723	5,660	5,512	3,437
Metal, refined:						
Primary		127,358	107,744	105,460	94,272	106,638
Secondary		175,088	178,016	189,831	188,603 r	167,480
Total		302,446	285,760	295,291	282,875 r	274,118
Magnesium, metal, secondary[e]		10,000	9,000	10,000	10,000	11,000
Manganese, oxide		51,095	45,867	49,115	45,680	45,500 e
Molybdenum, metal		610	465	561	812	901
Nickel metal:						
Refined		32,526	32,297 r	34,942 r	32,677 r	29,399
Ni content of nickel oxide sinter		49,600	48,950	52,700 r	60,300 r	56,700
Ni content of ferronickel		68,113	74,418	74,804 r	73,655 r	76,390
Ni content of chemical		2,394	1,820	2,084	2,082	2,208
Total		152,633	157,485 r	164,530 r	168,714 r	164,697
Platinum-group metals:[e]						
Palladium, metal	kilograms	4,805 4	5,618 4	5,500	5,300	5,400
Platinum, metal	do.	791 4	762 4	770	750	760
Rare-earth oxides[5]		5,109	5,423	5,521	6,015	6,432
Selenium, metal		735	752	734	599	625
Silicon, multicrystalline		4,334	4,453	5,045	6,135	6,923
Silver:						
Mine output, Ag content	kilograms	80,397	81,416	78,862	75,689	54,098
Metal:						
Primary	do.	2,293,028	2,259,551	2,453,204	2,208,270	2,202,795
Secondary[3]	do.	303,804	291,955	258,754	219,047	192,177
Total	do.	2,596,832	2,551,506	2,711,958	2,427,317	2,394,972
Tantalum, metal[e]		90	90	95	95	95
Tellurium, metal		39	29	33	33	23
Tin, metal, smelter		668	659	662	707	754
Titanium:						
Dioxide		256,961	240,469	253,453	253,364	259,015
Metal		24,906	25,199	18,923	23,110 r	31,000 e
Tungsten, metal		3,607	3,302	3,333	4,166	4,056
Vanadium, metal[e 6]		890	1,000	1,000	1,000	1,000

See footnotes at end of table.

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TABLE 1--Continued
JAPAN: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2001	2002	2003	2004	2005[p]
METALS--Continued						
Zinc:						
Mine output, Zn content		44,519	42,851	44,574	47,781	41,452
Oxide		75,414	74,515	75,090	75,813	74,843
Metal:						
Primary		541,277	547,183	532,704	534,830	536,768
Secondary		142,777	126,723	153,411	132,417	138,453
Total		684,054	673,906	686,115	667,247	675,221
Zirconium, oxide		7,930	8,650	8,800	9,800	9,700 e
INDUSTRIAL MINERALS						
Bromine[e]		15,000	20,000	20,000	20,000	20,000
Cement, hydraulic	thousand metric tons	76,550	71,828	68,766	67,376	69,629
Clays:						
Bentonite		415,102	437,772	425,945	455,282	421,629
Fire clay, crude[e]		475,665 [4]	480,000	460,000	470,000	460,000
Kaolin		17,240	11,756	12,409	11,553	10,500
Diatomite		129,267 r	123,827 r	111,690 r	126,225 r	130,005
Feldspar and related materials[e]		1,035,000 r	1,334,000 r	1,140,000 r	1,006,000 r	1,000,000
Gypsum	thousand metric tons	5,874	5,644	5,764	5,865	5,913
Iodine		6,643	6,548	6,524	7,264	8,095
Lime, quicklime	thousand metric tons	7,586	7,420	7,953	8,507	8,879
Nitrogen, N content of ammonia	do.	1,318	1,192	1,061	1,101	1,083
Perlite[e]		255,000	250,000	250,000	240,000 r	240,000
Salt, all types[7]	thousand metric tons	1,358	1,282	1,263	1,225	1,227
Silica:						
Sand	do.	5,768	4,893	4,699	4,705	4,700 e
Stone, quartzite	do.	14,213	13,568	12,838	12,218	11,900 e
Sodium compounds, n.e.s.:						
Soda ash[e]		461,204 [4]	410,000	400,000	400,000	400,000
Sulfate, anhydrous		146,780	137,713	132,807	130,107	138,000
Stone, crushed:						
Dolomite	thousand metric tons	3,389	3,450	3,579	3,695 r	3,490
Limestone	do.	182,255	170,166	163,565	161,858	165,240
Sulfur:						
Byproduct of metallurgy	do.	1,319	1,326	1,281	1,263	1,284
Byproduct of petroleum	do.	2,024	1,865	1,951	1,895	1,972
Talc and related materials:						
Talc		18,478 r	22,142 r	24,328 r	18,253 r	25,491
Pyrophyllite		403,137 r	416,188 r	408,435 r	405,222 r	351,111
Vermiculite[e]		6,500	6,400	6,200	6,200	6,200
MINERAL FUELS AND RELATED MATERIALS						
Carbon black	thousand metric tons	742	755	788	804	805
Coal, bituminous[8]	do.	3,208	1,368	1,338	1,339	1,146
Coke including breeze:						
Metallurgical	do.	38,402	38,417	38,544	38,314	38,095
Gas, natural:						
Gross[9]	million cubic meters	2,521	2,571	2,844	2,883	3,120
Marketed	do.	2,654 r	2,679 r	3,038 r	3,048 r	3,265

See footnotes at end of table.

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TABLE 1--Continued
JAPAN: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2001	2002	2003	2004	2005[p]
MINERAL FUELS AND RELATED MATERIALS--Continued						
Petroleum:						
Crude	thousand 42-gallon barrels	4,782	4,548	5,161	5,247	5,774
Refinery products:						
Gasoline:						
Aviation[e]	do.	40	40	50	50	50
Other	do.	364,714	364,129	367,687	366,662	368,102
Asphalt and bitumen	do.	33,151	31,537	32,586	34,475	33,288
Distillate fuel oil	do.	261,851	250,932	242,311	243,425	251,729
Jet fuel	do.	67,320	65,263	60,013	64,846	69,946
Kerosene	do.	176,655	169,472	177,963	167,348	177,091
Liquefied petroleum gas	do.	59,942	53,593	53,107	50,881	56,352
Lubricants	do.	16,304	16,630	16,314	16,561	16,580
Naphtha	do.	116,122	119,298	122,355	125,252	135,792
Paraffin, wax	do.	822	833	915	902	902
Petroleum coke	do.	4,700	4,549	4,000	4,533	4,394
Refinery fuel and losses[e, 10]	do.	150,000	150,000	150,000	150,000	150,000
Residual fuel oil	do.	409,780	398,673	435,763	406,901	400,936
Unfinished oils[e]	do.	50,000	50,000	50,000	50,000	50,000
Total[11]	do.	1,710,000	1,670,000	1,710,000	1,680,000	1,720,000

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [p]Preliminary. [r]Revised. -- Zero.

[1]Table includes data available through October 27, 2006.

[2]Includes unalloyed and alloyed ingot.

[3]Includes recovered from scrap and waste.

[4]Reported figure.

[5]Includes oxide of cerium, europium, gadolinium, lanthanum, neodymium, praseodymium, samarium, terbium, and yttrium.

[6]Represents metal content of vanadium pentoxide recovered from petroleum residues, ashes, and spent catalysts.

[7]Reported figure for fiscal year, which began on April 1 and ended on March 31 of the following year.

[8]All major coal mines had closed by January 2002, but eight smaller mines were still in operation in 2005.

[9]Includes output from gas wells and coal mines.

[10]May include some additional unfinished oils.

[11]Data are rounded to three significant digits; may not add to totals shown.

Sources: Ministry of Economy, Trade and Industry. Yearbook of Iron and Steel, Non-ferrous Metal, and Fabricated Metals Statistics, 2005; Yearbook of Chemical Industries Statistics, 2005; Yearbook of Ceramics and Building Materials Statistics, 2005; and Yearbook of Mineral Resources and Petroleum Products Statistics, 2005. Japan Aluminum Association, Aluminum Statistics, 2005. Arumu Publishing Co. Ltd. Industrial Rare Metals Annual Review No. 122, 2006. U.S. Geological Survey Mineral Questionnaire, 2001-04.

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TABLE 2
JAPAN: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement		Aso Cement Co. Ltd.	Tagawa and Kanda, Fukuoka Prefecture	2,400
Do.		Daiichi Cement Co. Ltd.	Kawasaki, Kanagawa Prefecture	1,169
Do.		Denki Kagaku K.K.	Omi, Niigata Prefecture	2,762
Do.		Hachinohe Cement Co. Ltd.	Hachinohe, Aomori Prefecture	1,533
Do.		Hitachi Cement Co. Ltd.	Hitachi, Ibaraki Prefecture	941
Do.		Mitsubishi Materials Corp.	Higashidori, Shimokita-gun, Aomori Prefecture; Higashiyama, Higashiiwai-gun, Iwate Prefecture; Yokoze, Saitama Prefecture; Kurosaki, Kyushu, and Higashitani, Fukuoka Prefecture	13,467
Do.		Mitsui Mining Co. Ltd.	Togawa, Fukuoka Prefecture	2,075
Do.		Myojo Cement Co. Ltd.	Itoigawa, Niigata Prefecture	2,482
Do.		Nippon Steel Chemical Co. Ltd.	Tobata, Kitakyushu, Fukuoka Prefecture	855
Do.		Nittetsu Cement Co. Ltd.	Muroran, Hokkaido Prefecture	1,589
Do.		Ryukyu Cement Co. Ltd.	Yabu, Nago, Okinawa Prefecture	722
Do.		Sumitomo Osaka Cement Co. Ltd.	Tamura, Fukushima Prefecture; Aso, Tochigi Prefecture; Motosu, Gifu Prefecture; Sakata, Shiga Prefecture; Ako, Hyogo Prefecture; and Susaki, Kochi Prefecture	14,402
Do.		Taiheiyo Cement Corp.	Ofunato, Iwate Prefecture; Chichibu, Kumagaya, and Saitama, Saitama Prefecture; Fujiwara, Mie Prefecture; Saiki and Tsukumi, Oita Prefecture; Kamiiso, Hokkaido Prefecture; and Tosa, Kochi Prefecture	28,800
Do.		Tokuyama Cement Co. Ltd.	Nanyo, Yamaguchi Prefecture	5,936
Do.		Tosoh Corp.	Shin Nanyo, Yamaguchi Prefecture	2,869
Do.		Tsuruga Cement Co. Ltd.	Tsuruga, Fukui Prefecture	1,710
Do.		Ube Industries Ltd.	Ube, Isa, Yamaguchi Prefecture; and Kanda, Fukuoka Prefecture	10,736
Coal		Kushiro Coal Mine Co. Ltd.[1]	Kushiro, Hokkaido Prefecture	750
Cobalt, refined	metric tons	Sumitomo Metal Mining Co. Ltd.	Niihama, Ehime Prefecture	600
Copper, refined	do.	Hibi Kyodo Smelting Co. Ltd. (Mitsui Mining and Smelting Co. Ltd., 64%; Nittetsu Mining Co. Ltd., 20%; Furukawa Co. Ltd., 16%)	Tamano, Okayama Prefecture	228,000
Do.	do.	Mitsubishi Materials Corp.	Naoshima, Kagawa Prefecture	225,600
Do.	do.	Nippon Mining and Metals Co. Ltd. (wholly owned subsidiary of Nikko Kyodo Co. Ltd.)	Hitachi, Ibaraki Prefecture; Saganoseki, Oita Prefecture	450,000
Do.	do.	Onahama Smelting and Refining Co. Ltd. (Mitsubishi Materials Corp., 49.29%; Dowa Mining Co. Ltd., 31.15%; Furukawa Co. Ltd., 8.31%; Furukawa Electric Co. Ltd. and Mitsubishi Cable Industries Ltd., 4.17% each; others, 2.91%	Onahama, Fukushima Prefecture	258,000
Do.	do.	Sumitomo Metal Mining Co. Ltd.	Besshi/Toyo (Saijyo), Ehime Prefecture	365,000
Do.	do.	Kosaka Smelting and Refining Co. Ltd. (wholly owned subsidiary of Dowa Mining Co. Ltd.)	Kosaka, Akita Prefecture	72,000
Gold:				
In concentrate	kilograms	Sumitomo Metal Mining Co. Ltd.	Hishikari, Kagoshima Prefecture	9,000
Refined	do.	Kosaka Smelting and Refining Co. Ltd. (wholly owned subsidiary of Dowa Mining Co. Ltd.)	Kosaka, Akita Prefecture	24,000
Do.	do.	Mitsui Mining and Smelting Co. Ltd.	Takehara, Hiroshima Prefecture	22,000
Do.	do.	Mitsubishi Materials Corp.	Naoshima, Kagawa Prefecture	60,000
Do.	do.	Nippon Mining and Metals Co. Ltd.	Hitachi, Ibaraki Prefecture	30,000
Do.	do.	Sumitomo Metal Mining Co. Ltd.	Niihama, Ehime Prefecture	36,000

See footnotes at end of table.

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TABLE 2--Continued
JAPAN: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Iodine, crude	metric tons	Ise Chemical Industries Co. Ltd. (Asahi Glass Co. Ltd., 52.4%, and Mitsubishi Corp., 11.2%)	Oami-Shirasato, and Ichinomya, Chiba Prefecture; and Sadowara, Miyazaki Prefecture	3,600
Do.	do.	Godo Shigen Sangyo Co. Ltd. (Kanto Natural Gas Development Co. Ltd., 11%, and Mitsui & Co. Ltd., 10%)	Chosei, Chiba Prefecture	2,400
Do.	do.	Kanto Natural Gas Development Co. Ltd. (Mitsui Chemicals, Inc., 21.9%, and Godo Shigen Sangyo Co. Ltd., 14.3%)	Mobara, Chiba Prefecture	1,200
Do.	do.	Nihon Tennen Gas Co. Ltd. (Kanto Natural Gas Development Co. Ltd., 50%, and Tomen Corp., 41%)	Shirako and Yokoshiba, Chiba Prefecture	1,200
Do.	do.	Toho Earthtech, Inc. (Itochi Corp., 34.1%; Mitsubishi Gas Chemical Co. Ltd., 32.2%; Nippon Light Metal Co. Ltd., 31.1%)	Kurosaki, Niigata Prefecture	720
Do.	do.	Nippon Chemicals Co. Ltd. (Nippon Shokubai Co. Ltd., 17%; Takeda Chemical Industries Ltd., 16.4%; Chugai Boyeki Co. Ltd., 13.6%)	Isumi, Chiba Prefecture	720
Lead:				
In concentrate		Toyoha Mining Co. Ltd. (wholly owned subsidiary of Nippon Mining and Metals Co. Ltd.)[2]	Toyoha, Hokkaido Prefecture	4
Refined	metric tons	Kamioka Mining and Smelting Co. Ltd.[3]	Kamioka, Gifu Prefecture	33,600
Do.	do.	Mitsui Mining and Smelting Co. Ltd.	Takehara, Hiroshima Prefecture	43,800
Do.	do.	Toho Zinc Co. Ltd.	Chigirishima, Hiroshima Prefecture	120,000
Do.	do.	Sumitomo Metal Mining Co. Ltd.	Harima, Hyogo Prefecture	30,000
Do.	do.	Kosaka Smelting and Refining Co. Ltd.	Kosaka, Akita Prefecture	25,200
Do.	do.	Hosokura Smelting and Refining Mining Co. Ltd. (wholly owned subsidiary of Mitsubishi Materials Corp.)[3]	Hosokura, Miyagi Prefecture	22,200
Limestone		Mitsubishi Materials Corp.	Higashitani, Fukuoka Prefecture	10,000
Do.		Nittetsu Mining Co. Ltd.	Torigatayama, Kochi Prefecture; Hanezuru, Tochigi Prefecture; and Shiriya, Aomori Prefecture	23,000
Do.		Sumikin Mining Co., Ltd.	Hachinohe Sekkai, Aomori Prefecture	5,500
Do.		Sumitomo-Osaka Cement Co. Ltd.	Ibuku, Shiga Prefecture, and Karazawa, Tochigi Prefecture	4,000
Do.		Shuho Mining Co., Ltd.	Sumitomo Cement Shuho, Yamaguchi Prefecture	8,200
Do.		Taiheiyo Cement Co. Ltd.	Ofunato, Iwate Prefecture; Ganji and Tsukumi, Oita Prefecture; Garo, Hokkaido Prefecture; Kawara, Fukuoka Prefecture, Tosayama, Kochi Prefecture; Taiheiyo Buko, Saitama Prefecture; and Shigeyasu, Yamaguchi Prefecture	46,000
Do.		Todaka Mining Co. Ltd.	Todaka-Tsukumi, Oita Prefecture	12,000
Do.		Ube Kosan Co. Ltd.	Ube Isa, Yamaguchi Prefecture	9,000
Manganese, electrolytic dioxide		Mitsui Mining and Smelting Co. Ltd.	Takehara, Hiroshima Prefecture	24
Do.		Tosoh Corp.	Hyuga, Miyazaki Prefecture	34
Nickel:				
In ferronickel	metric tons	Hyuga Smelting Co. Ltd. (wholly owned subsidiary of Sumitomo Metal Mining Co. Ltd.)	Hyuga, Miyazaki Prefecture	21,000
Do.	do.	Yakin Oheyama Co. Ltd.	Oheyama, Kyoto Prefecture	12,720
Do.	do.	Pacific Metals Co. Ltd.	Hachinohe, Aomori Prefecture	40,800
In oxide	do.	Tokyo Nickel Co. Ltd.	Matsuzaka, Mie Prefecture	60,000
Refined	do.	Sumitomo Metal Mining Co. Ltd.	Niihama, Ehime Prefecture	36,000

See footnotes at end of table.

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TABLE 2--Continued
JAPAN: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Pyrophyllite		Goto Kozan Co. Ltd.	Goto, Nagasaki Prefecture	204
Do.		Ohira Kozan Co. Ltd.	Ohira, Okayama Prefecture	132
Do.		Sankin Kogyo Co. Ltd.	Otsue, Hiroshima Prefecture	72
Do.		Shinagawa Shirenga Co. Ltd.	Mitsuishi, Okayama Prefecture	180
Do.		Shokozan Kogyosho Co. Ltd.	Yano-Shokozan, Hiroshima Prefecture	180
Do.		Showa Kogyo Co. Ltd.	Showa-Shokozan, Hiroshima Prefecture	60
Steel, crude		JFE Steel Corp. (wholly owned subsidiary of JFE Holdings Inc.)	Chiba, Chiba Prefecture; Kawasaki (Keihin), Kanagawa Prefecture; Nishinomiya, Hyogo Prefecture; Handa Aichi Prefecture; Fukuyama, Hiroshima Prefecture; and Kurashiki, Okayama Prefecture	33,835
Do.		Kobe Steel Ltd.	Kakogawa and Kobe, Hyogo Prefecture	8,943
Do.		Nippon Steel Corp.	Oita, Oita Prefecture; Kawata, Fukuoka Prefecture; Kimitsu, Chiba Prefecture; and Nagoya, Aichi Prefecture	33,199
Do.		Sumitomo Metal Industries, Ltd.	Kashima, Ibaraki Prefecture; Kokura, Fukuoka Prefecture; and Wakayama, Wakayama Prefecture	12,820
Titanium:				
In sponge metal		Sumitomo Titanium Corp. (Sumitomo Metal Industries Ltd., 75.2%, and Kobe Steel Ltd., 24.8%)	Amagasaki, Hyogo Prefecture	22
Do.		Toho Titanium Co. Ltd. (Nippon Mining and Metals Co. Ltd., 47%; Mitsui & Co. Ltd., 20%; others, 33%)	Chigasaki, Kanagawa Prefecture	15
In dioxide	metric tons	Fuji Titanium Industry Co. Ltd. (Ishihara Sangyo Kaishia Ltd., 24.8%, and others, 75.2%)	Kobe, Hyogo Prefecture	17,400
Do.	do.	Ishihara Sangyo Kaisha Ltd.	Yokkaichi, Mie Prefecture	154,800
Do.	do.	Sakai Chemical Industries Co. Ltd.	Onahama, Fukushima Prefecture	60,000
Do.	do.	Tayca Corp.	Saidaiji, Okayama Prefecture	60,000
Do.	do.	Titan Kogyo Kabushiki Kaisha	Ube, Yamaguchi Prefecture	16,800
Zinc:				
In concentrate		Toyoha Mining Co. Ltd.[2]	Toyoha, Hokkaido Prefecture	42
Refined	metric tons	Akita Smelting Co. Ltd. (Dowa Mining Co. Ltd., 57%; Nippon Mining and Metals Co. Ltd., 24%; Sumitomo Metal Mining Co. Ltd., 14%; Mitsubushi Materials Corp., 5%)	Iijima, Akita Prefecture	200,400
Do.	do.	Hachinohe Smelting Co. Ltd. (Mitsui Mining and Smelting Co. Ltd., 57.7%; Nippon Mining and Metals Co. Ltd., 27.8%; Toho Zinc Co. Ltd. and Nisso Smelting Co. Ltd., 14.5%)	Hachinohe, Aomori Prefecture	117,600
Do.	do.	Hikoshima Smelting Co. Ltd.	Hikoshima, Yamaguchi Prefecture	84,000
Do.	do.	Kamioka Mining and Smelting Co. Ltd.	Kamioka, Gifu Prefecture	72,000
Do.	do.	Toho Zinc Co. Ltd.	Annaka, Gunma Prefecture	139,200
Do.	do.	Sumitomo Metal Mining Co. Ltd.	Harima, Hyogo Prefecture	90,000

[1]Coal mining operation continued following establishment of Kushiro Coal Mining Co. Ltd. in 2002.
[2]Lead and zinc mining operations at the Toyoha Mine were scheduled to cease by the end of March 2006.
[3]Secondary lead smelter and refinery.

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TABLE 3
JAPAN: RESERVES OF MAJOR MINERAL COMMODITIES AS OF 2005

(Thousand metric tons unless otherwise specified)

Commodity		Exploitable reserves
Coal[1]		773,000
Copper ore, Cu content		28
Dolomite[2]		912,956
Gold ore, Au content	kilograms	159,000
Iodine		5,000 e
Lead ore, Pb content		293
Kaolin		5,086
Limestone[3]		40,372,079
Pyrophyllite		59,718
Silica sand[4]		73,623
Silica stone, white[5]		462,028
Silver ore, Ag content		2,300
Zinc ore, Zn content		1,220

eEstimated; estimated data are rounded to no more than three significant digits.

[1]Recoverable reserves, including brown coal.

[2]Average ore grade is 17.9% MgO.

[3]Average ore grade is 53.8% CaO.

[4]Average ore grade is 78.0% SiO_2.

[5]Average ore grade is 92.8% SiO_2.

Source: Natural Resources and Fuel Department, Agency of Natural Resources and Energy.

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TABLE 4
JAPAN: MINERALS TRADE[1]

(Million dollars)

Code	Commodity	Imports			Exports		
		2003	2004	2005	2003	2004	2005
25	Salt, sulfur, earths and stone, lime, plastering materials, cement	1,220	1,391	1,529	374	399	489
26	Ferrous and nonferrous metal ores, slag, ash	7,482	10,221	14,425	40	70	86
27	Mineral fuels, mineral oils, and products of their distillation; bituminous substances; mineral waxes	81,054	99,421	133,362	1,555	2,287	4,461
28	Inorganic chemicals; organic or inorganic compounds of precious metals, of rare-earth metals, of radioactive elements, or of isotopes	3,458	4,339	4,768	2,292	2,706	2,961
31	Fertilizers	530	641	710	86	103	110
68	Articles of stone, plaster, cement, asbestos, mica, or similar materials	1,150	1,168	1,254	1,016	1,251	1,387
69	Ceramic products	760	880	968	912	1,089	1,210
70	Glass and glassware	1,362	1,752	1,870	2,788	3,456	3,774
71	Natural or cultured pearls; precious or semiprecious stones; precious metals, metals clad with precious metals and articles thereof; imitation jewelry; coins	5,705	7,685	8,443	2,149	2,491	3,017
72	Iron and steel	3,093	5,258	6,818	15,717	21,187	24,401
73	Articles of iron and steel	2,852	3,524	4,268	6,225	7,678	9,425
74	Copper and articles thereof	761	1,196	1,216	2,388	3,199	3,864
75	Nickel and articles thereof	1,384	2,187	2,127	458	786	864
76	Aluminum and articles thereof	5,447	6,592	7,200	1,722	1,965	2,027
78	Lead and articles thereof	18	26	41	18	27	24
79	Zinc and articles thereof	63	78	103	89	105	115
80	Tin and articles thereof	156	297	285	56	85	95
81	Other base metals, cermets, articles thereof	840	1,685	1,773	643	859	1,173
	Total	117,335	148,341	232,119	38,528	49,743	59,483
	Total trade	382,761	454,867	516,782	470,650	565,342	595,794

[1]Values have been converted from Japanese yen (¥) to U.S. dollars (US$) at a rate of ¥115.9=US$1.00 for 2003, ¥108.2=US$1.00 for 2004, and ¥110.2=US$1.00 for 2005.

Source: Ministry of Finance, Japan Exports & Imports, Commodity by Country, December 2003-2005.

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TABLE 5
JAPAN: DOMESTIC DEMAND FOR GOLD AND SILVER

Item		2001	2002	2003	2004	2005
Gold:						
Dental and medical	kilograms	20,813	21,765	22,373	21,383	20,881
Electrical, electronic, and communication	do.	70,916	80,415	85,112	86,315	100,718
Gold plating	do.	22,615	22,513	23,512	23,612	20,118
Jewelry	do.	37,512	37,128	20,489	20,189	20,451
Decorations and badges	do.	1,474	1,392	1,499	1,412	1,244
Pottery and porcelain	do.	975	1,149	1,532	1,420	1,415
Fountain pens	do.	14	15	15	--	--
Watches	do.	778	785	790	786	799
Industrial arts and crafts	do.	4,893	4,697	4,879	4,653	4,785
Private hoarding	do.	69,586	85,569	79,481	80,526	80,983
Other	do.	32,919	47,755	48,317	49,302 r	46,723
Total	do.	262,495	303,183	287,999	289,598	298,117
Silver:						
Silver nitrate for photography	metric tons	1,663	1,532	1,365	1,243	969
Silver nitrate for other uses	do.	150	220	295	307	299
Electrical contacts	do.	202	153	219	260	209
Brazing alloy	do.	111	98	95	105	102
Rolled products	do.	193	216	228	248	214
Other	do.	636	455	474	434	386
Total	do.	2,955	2,674	2,676	2,597	2,179

-- Zero.

Sources: Arumu Publishing Co. Ltd., Industrial Rare Metals Annual Reviews, Nos. 120, 121, and 122; Ministry of Economy, Trade and Industry, Yearbook of Iron and Steel, Nonferrous Metals, and Fabricated Metals Statistics, 2005.

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TABLE 6
JAPAN: DOMESTIC ORDERS FOR ORDINARY AND SPECIALTY STEEL PRODUCTS, BY END USE

(Thousand metric tons)

End use	2001	2002	2003	2004	2005
Automobiles:					
Ordinary steel	9,430	10,310	10,580	10,760	11,140
Specialty steel	2,590	2,990	3,230	3,640	4,150
Total	12,020	13,300	13,810	14,400	15,290
Construction:					
Ordinary steel	13,550	13,580	13,300	13,380	13,130
Specialty steel	720	640	710	720	690
Total	14,270	14,220	14,010	14,100	13,820
Conversion and processing:					
Ordinary steel	2,910	2,790	2,760	2,800	2,560
Specialty steel	3,260	3,560	3,880	4,340	4,790
Total	6,170	6,350	6,640	7,140	7,350
Electric machinery and equipment:					
Ordinary steel	1,940	1,840	1,940	2,030	2,010
Specialty steel	130	130	160	180	160
Total	2,070	1,970	2,100	2,210	2,170
Home and office appliances:					
Ordinary steel	550	540	580	610	600
Specialty steel	210	200	200	190	180
Total	760	740	780	800	780
Industrial machinery and equipment:					
Ordinary steel	1,290	1,360	1,650	1,920	2,070
Specialty steel	940	980	1,180	1,390	1,460
Total	2,230	2,340	3,830	3,310	3,530
Shipbuilding and marine equipment:					
Ordinary steel	3,480	3,420	3,530	4,290	4,860
Specialty steel	140	180	210	140	140
Total	3,620	3,600	3,740	4,430	5,000
Steel dealers:					
Ordinary steel	17,930	17,480	17,070	17,400	16,510
Specialty steel	1,230	1,210	1,350	1,470	1,440
Total	19,160	18,690	18,420	18,870	17,950
Tanks and containers:					
Ordinary steel	1,620	1,560	1,600	1,600	1,440
Specialty steel	20	20	20	30	40
Total	1,640	1,580	1,620	1,630	1,480
Other:					
Ordinary steel	570	500	410	430	420
Specialty steel	110	110	120	140	120
Total	680	610	530	570	540
Total domestic demand:					
Ordinary steel	53,270	53,380	53,420	55,220	54,740
Specialty steel	9,350	10,020	11,060	12,240	13,170
Grand total	62,620	63,400	64,480	67,460	67,910

Source: The Japan Iron and Steel Federation, The Steel Industry of Japan 2004-2006.

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TABLE 7
JAPAN: EXPORTS OF IRON AND STEEL PRODUCTS, BY PRINCIPAL DESTINATION

(Thousand metric tons)

Destinations	2001	%	2002	%	2003	%	2004[r]	%	2005	%
China	4,566	15.0	6,532	18.0	6,435	18.7	6,894	19.5	5,783	17.7
Korea, Republic of	6,537	21.5	9,198	25.3	8,978	26.1	8,952	25.4	7,738	23.7
Taiwan	2,528	8.3	3,263	9.0	3,280	9.5	3,235	9.2	3,605	11.1
Thailand	2,572	8.4	3,350	9.2	3,593	10.4	3,863	11.0	4,099	12.6
Middle East	1,523	5.0	1,074	3.0	1,172	3.4	1,001	2.8	1,383	4.2
Europe	1,193	3.9	715	2.0	742	2.2	1,098	3.1	768	2.4
United States	2,206	7.2	1,485	4.1	1,076	3.1	1,428	4.0	1,451	4.4
All other countries	9,353	30.7	10,706	29.4	9,135	26.6	8,831	25.1	7,778	23.9
Total	30,478	100.0	36,323	100.0	34,411	100.0	35,302	100.0	32,605	100.0

[r]Revised.

Source: The Japan Iron and Steel Federation, Monthly Report of the Iron and Steel Statistics and The Steel Industry of Japan 2001-05.

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TABLE 8

JAPAN: MAJOR OVERSEAS DEVELOPMENT PROJECTS OF NONFERROUS METALS MINES IN THE 1990s AND 2000s, AN UPDATE IN 2005

	Australia			Canada	
				British Columbia	
	Cadia Hill/Ridgeway	McArthur River, Northern Territory[1]	Northparkes, New South Wales	Mount Polley[2]	Huckleberry
Nature of project involvement	Long-term loan	Investment in exploration and development	Investment in exploration and development	Equity participation	Equity participation and provided loan
Participating Japanese companies and their equity share	Pan Pacific Copper Co. Ltd.	ANT Minerals Pty Ltd., 25% ANT Minerals was 50% owned by Nippong Mining & Metals Co Ltd., 16.7% owned each by three other Japanese companies	Sumitomo Metal Mining Oceania Pty., 13.3%, and SC Mineral Resources Ltd. of Australia, 6.7%	Sumitomo Corp. sold its 47.5% equity interest to Imperial Metals Corp. in 2000	Mitsubishi Materials Corp., 31.25%; Dowa Mining Co. Ltd., 6.25%; Furukawa Co. Ltd., 6.25%; Marubeni Corp., 6.25%.
Majority equity holder and/or other equity holder	NewCrest Mining Co. Ltd.	Mount Isa Mines Ltd. (MIM), 75% MIM was part of Xstrata Zinc	North Broken Hill Peko Ltd. of Australia, 80%	Imperial Metals Corp. of Canada, 100%[1]	Princeton Mining Corp. of Canada, 50%.
Mineral commodity involved	Copper and gold	Lead, silver, and zinc	Copper and gold	Copper and gold	Copper.
Estimated reserves and ore grade	Cadia, 210 million metric tons, 0.18% copper, 0.72 gram per metric ton gold; Ridgeway, 41 million metric tons, 0.75% copper, 2.7 grams per metric ton gold	39.9 million metric tons, 5.5% lead, 12.6% zinc, 55 grams per metric ton silver	63.7 million metric tons, 1.108% copper, 0.487 gram per metric ton gold	81.5 million metric tons, 0.3% copper, 0.42 gram per metric ton gold	56.5 million metric tons, 0.494% copper, 0.014% molybdenum.
Type of mine	Cadia, open pit; Ridgeway, underground	Underground	Open pit and underground	Open pit	Open pit.
Total cost of the project	$726 million (Australian) (Cadia and Ridgeway)	$296 million (Australian)	$303 million (Australian)	$123 million (Canadian)	$136 million (Canadian).
Japanese share	$160 million (in cash)	$29 million (Australian)	$75.6 million (Australian)	$109 million (Canadian)	$78 million (Canadian).
Annual production capacity	250,000 metric tons of copper concentrate (Cadia and Ridgeway)	1,270,000 metric tons of crude ore containing 6.1% lead, 15.4% zinc	3,934,000 metric tons of crude ore containing 1.73% copper plus 0.88 gram per metric ton gold	6,500,000 metric tons of crude ore	7,145,600 metric tons of crude ore continuing 0.502% copper, 0.013% molybdenum.
Annual shipment to Japan	50,000 metric tons of copper and 11 metric tons of gold	4,338 metric tons of lead and 23,052 metric tons of zinc in mixed concentrate	22,098 metric tons of copper in concentrate	15,000 metric tons of copper in concentrate plus gold value	28,277 metric tons of copper in concentrate.
Construction started	Cadia, 1996; Ridgeway, 2000	August 1993	May 1993	September 1996	1996.
Production started or planned	Cadia, 1998; Ridgeway, 2002	September 1995	October 1995	June 1997	October 1997.

See footnotes at end of table.

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TABLE 8--Continued

JAPAN: MAJOR OVERSEAS DEVELOPMENT PROJECTS OF NONFERROUS METALS MINES IN THE 1990s AND 2000s, AN UPDATE IN 2005

	Chile				
		Region III			
	Collahuasi, Region I	La Candelaria	Atacama Kozan	Ojos del Salado	Los Pelembres, Region IV
Nature of project involvement	Equity participation and provided loan	Investment in exploration and development	Investment in exploration and development	Equity participation	Equity participation.
Participating Japanese companies and their equity share	Mitsui and Co. Ltd., 7.4%; Mitsui Mining and Smelting Co. Ltd., 1.0%; Nippon Mining and Metals Co., Ltd., 3.6%	Sumitomo Metal Mining Co. Ltd., 16%, and Sumitomo Corp., 4%	Nittetsu Mining Co. Ltd., 60%	Sumitomo Metal Mining Co. Ltd., 16%, and Sumitomo Corp., 4%	Nippon Mining and Metals Co. Ltd., 15%; Mitsubishi Materials Corp., 10%; Marubeni Corp., 8.75%; Mitsubishi Corp., 5%; Mitsui and Co. Ltd., 1.25%.
Major equity holder and/or other equity holder	Falconbridge Ltd. of Canada, 44%, and Anglo American plc of the United Kingdom, 44%	Phelps Dodge Corp. of the United States, 80%	Inversiones Errazuriz Ltda. of Chile, 40%	Phelps Dodge Corp. of the United States, 80%	Antofagasta plc of the United Kingdom, 60%.
Mineral commodity involved	Copper	Copper and gold	Copper	Copper	Copper.
Estimated reserves and ore grade	1,808.2 million metric tons, 0.91% copper	366 million metric tons, 0.84% copper, 0.205 gram per metric ton gold	30 million metric tons, 1.5% copper, 0.26 gram per metric ton gold	17 million metric tons, 1.32% copper, 0.27 gram per metric ton gold	2,074 million metric tons, 0.65% copper.
Type of mine	Open pit	Open pit	Underground	Underground	Open pit.
Total cost of the project	$1,760 million	$592 million	$111 million	Estimated cost $125 million	$1,360 million.
Japanese share	$375 million	$296 million	$101 million	$25 million	$614 million.
Annual production capacity	25,600,000 metric tons of crude ore	10,000,000 metric tons of crude ore	1,650,000 metric tons of crude ore	60,000 metric tons of copper concentrate	34,000,000 metric tons of crude ore.
Annual shipment to Japan	96,023 metric tons of copper in concentrate	85,313 metric tons of copper in concentrate	13,000 metric tons of copper in concentrate	12,000 metric tons of copper concentrate	163,200 metric tons of copper in concentrate.
Construction started	1996	April 1993	May 1999	1920, but ceased operations in 1998	November 1997.
Production started or planned	January 1999	March 1995	June 2003	2004 resumed operations	April 2000.

See footnotes at end of table.

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TABLE 8--Continued
JAPAN: MAJOR OVERSEAS DEVELOPMENT PROJECTS OF NONFERROUS METALS MINES IN THE 1990s AND 2000s, AN UPDATE IN 2005

	Indonesia, Batu Hijau, Sumbawa Island	Mexico	
		Tizapa, Mexico City	Rey de Plata, Guerrero
Nature of project involvement	Equity participation	Investment in exploration and development	Investment in exploration and development.
Participating Japanese companies and their equity share	Sumitomo Corp., 26%; Sumitomo Metal Mining Co. Ltd., 5.0%; Mitsubishi Materials Corp., 2.5%; Furukawa Co. Ltd., 1.5%	Dowa Mining Co. Ltd., 39%, and Sumitomo Corp., 10%	Dowa Mining Co. Ltd., 39%, and Sumitomo Corp., 10%.
Majority equity holder and/or other equity holder	Newmont Gold Co. of the United States, 45%, and P.T. Pukuafu Indah of Indonesia, 20%	Industrias Penoles SA de C.V. of Mexico, 51%	Industrias Penoles SA de C.V. of Mexico, 51%.
Mineral commodity involved	Copper and gold	Copper, lead, and zinc	Copper, lead, and zinc.
Estimated reserves and ore grade	907.3 million metric tons, 0.44% copper, 0.377 gram per metric ton gold	2.5 million metric tons, 0.61% copper, 1.36% lead, 6.56% zinc plus gold and silver	2.9 million metric tons, 0.68% copper, 2.56% lead, 8.78% zinc plus gold and silver.
Type of mine	Open pit	Underground	Underground.
Total cost of the project	$1,925 million	$38.2 million	$45.4 million.
Japanese share	$513 million	$35.1 million	$41.3 million.
Annual production capacity	43,870,000 metric tons of crude ore containing 0.75% copper and 0.44 gram per metric ton gold	480,000 metric tons of crude ore	330,000 metric tons of crude ore.
Annual shipment to Japan	92,128 metric tons of copper in concentrate	23,500 metric tons of zinc in concentrate	21,985 metric tons of zinc in concentrate.
Construction started	September 1996	May 1992	January 1998.
Production started or planned	October 1999	November 1994	October 2000.

See footnotes at end of table.

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TABLE 8--Continued
JAPAN: MAJOR OVERSEAS DEVELOPMENT PROJECTS OF NONFERROUS METALS MINES IN THE 1990s AND 2000s, AN UPDATE IN 2005

	Peru			The Philippines	United States
	Antamina, Ancash	Cerro Verde, Arequipa	Pallca, Ancash	Padcal, Luzon	Pogo, Alaska
Nature of project involvement	Investment in exploration and development	Equity participation (planned)	Equity participation	Long-term loan	Mine owned by Sumitomo Metal Mining Co. Ltd.
Participating Japanese companies and their equity share	Mitsubishi Corp., 10%	Sumitomo Metal Mining Co. Ltd., 21% (planned)	Mitsui & Co. Ltd., 30%	Pan Pacific Copper Co. Ltd.	Teck Cominco Co., 40%, and SC America Minerals, Inc., 9%.
Major equity holder and/or other equity holder	Noranda Inc. of Canada and BHP Billiton plc of the United Kingdom, 33.75% each, and Teck Cominco Ltd. of Canada, 22.5%	Phelps Dodge Corp., 53.6%; Compania de Minas Buenaventura S.A.A., 18.2%; others, 7.2%	Mitsui Mining and Smelting Co. Ltd., 70%	Philex Mining Corp.	Sumitomo Metal Mining America Inc., 51%.
Mineral commodity involved	Copper and zinc	Copper	Lead and zinc	Copper and gold	Gold.
Estimated reserves and ore grade	559 million metric tons, 1.23% copper, 1.03% zinc, 0.03% molybdenum	1,033 million metric tons, 0.514% copper, 0.01% molybdenum	6 million metric tons, 1% lead, 12% zinc	34.9 million metric tons, 0.28% copper, 0.78 gram per metric ton gold	152 metric tons.
Type of mine	Open pit	Open pit	Underground	Underground	Underground.
Total cost of the project	$2,296 million	$850 million	$6.2 million	$15 million	$280 million.
Japanese share	$404 million	About $265 million	Unknown	$15 million	$168 million.
Annual production capacity	25,600,000 metric tons of crude ore	180,000 metric tons of copper in concentrate	170,000 metric tons of crude ore	8,970,000 metric tons of crude ore (0.28% Cu, 0.41 g/t Au) or 70,000 metric tons of copper copper concentrate	12 metric tons of gold.
Annual shipment to Japan	10,579 metric tons of copper in concentrate	Approximately 90,000 metric tons of copper in concentrate	Unknown	15,000 metric tons of copper and 2 metric tons of gold in copper concentrate	Unknown.
Construction started	1998	Unknown	2005	December 2003	June 2004.
Production started or planned	June 2001	Fourth quarter of 2006	March 2006	2006	March 2006.

[1]ANT Minerals Pty Ltd. (50% owned by Nippon Mining & Metal Co. Ltd., and 16.7% owned each by Marubeni Corp., Mitsui & Co. Ltd., and Toyoha Mining Co. Ltd.), which owned 25% interest in McArthur River Mine, sold all its interest to Xstrata plc through Mount Isa Mines Ltd., which was part of Xstrata Zinc (one of the Xstrata plc companies), in September 2005.

[2]SC Minerals Canada Ltd. (a wholly owned subsidiary of Sumitomo Corp.) sold its 47.5% interest in Mount Polley Copper Project to Imperial Metals Corp. of Canada for $4.5 million by the end of 2000.

Sources: Research Institute of Economy, Trade and Industry (Chosakai), Mining Handbook (Kogyo Benran), 2002, p. 210-217; Japan Oil, Gas and Metals National Corp., Metal Mining Data Book, 2005, p. 196-201.

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TABLE 9
JAPAN: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity	2004	2005	Destinations, 2005: United States	Destinations, 2005: Other, principal
METALS				
Alkali and alkaline-earth metals	196	138	8	China 93; Thailand 6; Other 19.
Aluminum:				
Ore and concentrate	915	673	--	Republic of Korea 300; China 40; Other 320.
Oxides and hydroxides	285,508	259,647	3,585	Republic of Korea 115,577; China 51,321; Other 34,340.
Ash and residue containing aluminum	27,540	30,933	--	China 28,899; Republic of Korea 1,157; Indonesia 740.
Metal, including alloys:				
Scrap	79,001	95,664	46	China 85,070; Hong Kong 5,331; Republic of Korea 2,813.
Unwrought	36,303	34,419	1,012	Thailand 12,018; Republic of Korea 4,695; China 4,560.
Semimanufactures, all forms	309,469	275,967	23,159	China 66,906; Thailand 43,247; Malaysia 30,008.
Antimony:				
Ore and concentrate	904	--	--	NA.
Oxides	2,578	2,151	175	Malaysia 265; Thailand 265; Singapore 258.
Metal, including alloys, all forms[2]	464	264	1	Thailand 10; Indonesia 6; Other 244.
Arsenic, metal, including alloys, all forms	5	5	3	Republic of Korea 1; United Kingdom 1.
Beryllium, metal, including alloys, all forms	8	17	8	China 6; Other 3.
Bismuth, metal, including alloys, all forms[2]	39	60	--	Belgium 14; United Kingdom 12; China 11.
Cadmium, metal, including alloys, all forms	1,411	1,503	620	China 466; Republic of Korea 189; France 78.
Chromium:				
Ore and concentrate	191	32	--	Republic of Korea 24; Philippines 5; Thailand 3.
Oxides and hydroxides	6,032	5,988	725	Republic of Korea 3,007; Thailand 284; Other 1,163.
Metal, including alloys, all forms	907	1,626	479	China 624; United Kingdom 207; Other 127.
Cobalt:				
Oxides and hydroxides	1,206	850	4	China 582; Finland 130; Republic of Korea 45.
Metal, including alloys, all forms	2,095	2,495	264	Canada 888; China 590; United Kingdom 174.
Columbium (niobium) and tantalum, tantalum metal, including alloys, all forms	445	389	126	Germany 54; Israel 54; Thailand 35.
Copper:				
Ore and concentrate	-- r	--	--	NA.
Matte, including cement copper	(3)	979	--	China 519; Republic of Korea 461.
Oxides and hydroxides	1,988	2,178	4	Republic of Korea 757; Malaysia 694; China 370.
Sulfate	4,325	3,731	18	Republic of Korea 421; Hong Kong 339; Other 2,498.
Ash and residue containing copper	--	2	--	Hong Kong 2.
Metal, including alloys:				
Scrap	329,909	424,054	102	China 385,129; Hong Kong 13,518; Republic of Korea 13,222.
Unwrought	227,785	289,385	6,890	China 102,339; Republic of Korea 44,569; Other 108,583.
Semimanufactures, all forms	308,680	276,663	11,226	China 61,859; Malaysia 35,786; Other 3,094.
Germanium, metal, including alloys, all forms	6	2	(3)	China 1; Other 1.
Gold, metal, including alloys, unwrought and partly wrought	90	107	(3)	Malaysia 21; Singapore 21; Othe 17.
Iron and steel:				
Iron ore and concentrate	591	54,910	--	Vietnam 41,200; Thailand 7,700; Other 5,903.
Metal:				
Scrap thousand metric tons	6,809	7,576	(3)	China 3,461; Republic of Korea 2,874; Other 875.
Pig iron, cast iron, related materials	85,843 r	86,223	4,619	Republic of Korea 40,530; China 16,309; Thailand 12,734.
Ferroalloys:				
Ferrochromium	2,597	3,495	3,073	Indonesia 33; Thailand 288; Republic of Korea 25.
Ferromanganese	9,870	9,649	3,300	Malaysia 1,400; Thailand 1,122; Other 2,552.
Ferromolybdenum	43	331	--	Thailand 118; Malaysia 56; Other 54.

See footnotes at end of table.

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TABLE 9--Continued
JAPAN: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2004	2005	Destinations, 2005: United States	Destinations, 2005: Other, principal
METALS--Continued					
Iron and steel--Continued:					
Metal--Continued:					
Ferroalloys--Continued:					
Ferronickel		111,024	125,625	--	Republic of Korea 60,784; China 12,217; Other 52,625.
Ferrosilicochromium		1,097	--	--	NA.
Ferrosilicomanganese		168	12	--	China 3; Other 9.
Ferrosilicon		7,391	2,070	--	Republic of Korea 862; Indonesia 757; China 171.
Ferrotungsten		2	(3)	--	All to Thailand.
Silicon metal		902	1,052	7	China 641; United Kingdom 33; Other 116.
Lead:					
Ore and concentrate		3,401 r	6,140	--	China 6,137; Philippines 3.
Oxides		618	637	4	Malaysia 279; Thailand 160; Germany 90.
Ash and residue		--	338	--	All to Republic of Korea.
Metal, including alloys:					
Scrap		19,635	8,900	--	Republic of Korea 5,831; China 2,878; Malaysia 191.
Unwrought		19,401	14,662	228	China 5,997; Indonesia 3,092; Hong Kong 2,173.
Semimanufactures		1,140	1,166	7	Indonesia 140; China 136; Other 753.
Lithium:					
Oxide and hydroxide		17	263	--	Republic of Korea 126; China 117; Germany 11.
Magnesium, metal, including alloys:					
Scrap		23	40	--	All to United Kingdom.
Unwrought	value, thousands	$657	$735	$3	Republic of Korea $65; Canada $18; Other $619.
Semimanufactures		2,098	482	2	China 449; Republic of Korea 10; Other 11.
Manganese:					
Ore and concentrate		42,244	31,226	--	All to China.
Oxides		29,229	29,366	4,954	Indonesia 9,624; Singapore 6,930; China 2,658.
Metal, including alloys, all forms		261	1,028	11	Republic of Korea 946; China 28; Philippines 12.
Mercury		54	107	--	Netherlands 86; India 9; Kenya 4.
Molybdenum:					
Ore and concentrate:					
Roasted		2	684	--	Republic of Korea 547; Italy 119; India 18.
Unroasted	value, thousands	$11 r	$20	--	Singapore $12; Thailand $4; Vietnam $4.
Oxides and hydroxides		132	155	36	Kuwait 10; Singapore 4; Other 99.
Metal, including alloys, all forms		486 r	689	62	Republic of Korea 271; Austria 51; Other 225.
Nickel:					
Ore and concentrate	value, thousands	$72	$2	--	All to Thailand.
Matte and speiss		32,682	34,546	--	Republic of Korea 18,118; United Kingdom 440; Other 15,743.
Oxides and hydroxides		6,731	6,130	547	China 3,349; Hong Kong 752; Other 749.
Metal, including alloys:					
Scrap		400	1,125	319	United Kingdom 521; Vietnam 105; China 41.
Unwrought		1,433	2,111	1	China 1,083; Hong Kong 482; Republic of Korea 91.
Semimanufactures		15,915	15,693	843	China 2,130; Germany 563; Hong Kong 499.
Platinum-group metals, including alloys, unwrought and partly wrought:					
Palladium	value, thousands	$52	$42	$7	Austria $10; Republic of Korea $10; China $4.
Platinum	do.	$144	$267	$6	Hong Kong $115; China $77; Thailand $15.
Rhodium	do.	$3	$30	(3)	China $22; Hong Kong $2; Thailand $2.
Iridium, osmium, ruthenium		$2	$4	(3)	Mainly to Singapore.
Rare-earth, metal, including alloys, all forms		277	592	(3)	Philippines 548; China 20; Hong Kong 15.
Selenium		539	435	4	China 189; Hong Kong 76; India 50.
Silicon		6,175	5,742	487	United Kingdom 1,715; China 878; Republic of Korea 756.

See footnotes at end of table.

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TABLE 9--Continued
JAPAN: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2004	2005	Destinations, 2005: United States	Destinations, 2005: Other, principal
METALS--Continued					
Silver:					
Ore and concentrate		--	104	--	All to Belgium.
Metal, including alloys, unwrought and partly wrought	value, thousands	$181	$238	$20	Hong Kong $50; China $30; Other $56.
Tin, metal, including alloys:					
Scrap		600	523	--	Belgium 227; United Arab Emirates 194; Hong Kong 44.
Unwrought		973	1,083	1	Philippines 364; China 229; Vietnam 114.
Semimanufactures		2,944	2,862	132	China 846; Republic of Korea 337; Japan 171.
Titanium:					
Ore and concentrate		84	86	--	Singapore 31; Germany 4; Other 49.
Oxides		31,058	26,334	1,073	China 9,486; Republic of Korea 2,250; Other 7,227.
Metal, including alloys, all forms		23,203 r	25,231	10,396	United Kingdom 3,219; China 1,942; Republic of Korea 1,871.
Tungsten:					
Ore and concentrate		533	188	--	China 184; Other 4.
Metal, including alloys, all forms		2,287	2,474	365	China 672; Germany 441; Other 400.
Uranium and thorium, metal, including alloys, all forms		1	--	--	NA.
Vanadium:					
Oxides and hydroxides		221	385	1	Republic of Korea 354; Thailand 6; Other 6.
Metal, including alloys, all forms		32	14	(3)	Mainly to Singapore.
Zinc:					
Ore and concentrate		3,013	4,607	--	All to China.
Oxides		2,416	2,309	62	Thailand 517; China 433; Other 203.
Blue powder		10	88	--	Mainly to Other Asia, nes.
Ash and residue containing zinc		2,379	6,655	--	Republic of Korea 1,095; China 5,162; Thailand 122.
Metal, including alloys:					
Scrap		3,617	3,898	--	China 3,536; Republic of Korea 39; Other 260.
Unwrought		76,188	65,371	4	Indonesia 16,042; Vietnam 5,834; Other 22,183.
Semimanufactures		3,343	4,487	339	China 1,428; Indonesia 941; Singapore 494.
Zirconium:					
Ore and concentrate		1,143	1,741	3	Mainly to China.
Metal, including alloys, all forms		50	99	9	Thailand 64; Hong Kong 5; Other 5.
INDUSTRIAL MINERALS					
Abrasives (not elsewhere specified):					
Natural, corundum, emery, pumice, and so forth		28,873	31,152	55	Republic of Korea 14,043; China 10,388; Other 3,416.
Artificial:					
Corundum		22,202	19,038	1,658	Republic of Korea 4,902; China 3,130; Malaysia 2,082.
Silicon carbide		9,123	10,531	1,382	Republic of Korea 2,991; Malaysia 964. Other 1,713.
Dust and powder of precious and semiprecious stones, including diamond	value, thousands	$251	$289	$46	Hong Kong $35; Other $156.
Grinding and polishing wheels and stones		10,381	10,103	1,063	Indonesia 1,891; Republic of Korea 1,301; Thailand 925.
Asbestos, crude	value, thousands	$4	$37	--	China $21; Hong Kong $11.
Barite and witherite	do.	$27	$32	$23	Mainly to Vietnam.
Boron materials:					
Crude natural borates	do.	$61	$56	--	China $27; Singapore $20.
Oxides and acids		343	397	84	Republic of Korea 157; China 19; Othe 102.
Cement	thousand metric tons	10,313	10,197	4	Hong Kong 1,758; Republic of Korea 1,508; Singapore 1,207.
Chalk		1,921	1,683	--	Republic of Korea 936; Indonesia 414; Other 210.

See footnotes at end of table.

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TABLE 9--Continued
JAPAN: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2004	2005	Destinations, 2005: United States	Destinations, 2005: Other, principal
INDUSTRIAL MINERALS--Continued					
Clays, crude:					
Bentonite		2,814	4,465	48	Thailand 1,890; Indonesia 1,524; Other 336.
Chamotte or dinas earth		54	13	--	Mainly to Republic of Korea.
Fire clay		3,175	2,599	1	Republic of Korea 839; Thailand 415; Other 385.
Fuller's earth		2	1	--	All to China.
Kaolin		4,731	10,055	42	China 6,836; Egypt 472; Other 1,189.
Unspecified		22,290	29,035	2,533	Indonesia 6,556; Vietnam 4,434; Other 3,637.
Diamond, natural:					
Gem, not set or strung	value, thousands	$27,810	$40,006	$12,001	Hong Kong $17,759; Israel $402; Republic of Korea $394.
Industrial stones	do.	$2,908	$3,073	$148	Republic of Korea $340; China $233; Other $672.
Dust and powder	do.	$7,970	$8,328	$5,349	China $1,083; Republic of Korea $821; Thailand $548.
Diatomite and other infusorial earth		3,673	3,763	853	Vietnam 685; Thailand 615; Other 714.
Feldspar		2,466	2,432	--	Thailand 766; Hong Kong 211; Malaysia 83.
Fluorspar	value, thousands	$457	$1,507	$5	Germany $1,127; Singapore $280; Thailand $50.
Fertilizer materials:					
Crude (not elsewhere specified)		10,653	20,891	1	China 17,960; Republic of Korea 1,651; Other 382.
Manufactured:					
Ammonia		6,669	8,353	1,181	Republic of Korea 1,906; Singapore 1,418; Other 2,427.
Nitrogenous		869,615	855,099	1,993	Vietnam 289,600; Malaysia 260,197; Thailand 54,852.
Phosphatic		400	419	97	China 187; Other 90.
Potassic		444	283	162	Indonesia 42; Republic of Korea 39; Other 30.
Graphite, natural		1,579	1,702	210	Republic of Korea 522; Brazil 172; China 171.
Gypsum and plaster		4,267	4,114	61	Bangladesh 1,481; Republic of Korea 728; Other 559.
Iodine		5,211	5,091	1,366	Norway 702; United Kingdom 564; France 537.
Kyanite and related materials, mullite and unspecified		3,870	2,575	13	Republic of Korea 1,768; China 134; Other 219.
Lime		4,378	4,642	219	Singapore 1,197; Republic of Korea 891; Other 1,391.
Magnesium compounds:					
Magnesite, crude		90	90	--	Thailand 36; Republic of Korea 30; Other 24.
Oxides and hydroxides		48,499	46,545	5,616	Republic of Korea 13,957; China 5,940; Other 6,658.
Mica:					
Crude including splittings and waste		1,377	1,963	350	Thailand 466; China 454; Republic of Korea 169.
Worked including agglomerated splittings		1,883	1,408	11	Austria 624; Republic of Korea 109; Other 104.
Nitrates, crude		1,628	2,899	--	Indonesia 1,227; Thailand 646; China 309.
Phosphates, crude		9	12	--	All to Vietnam.
Phosphorus, elemental		31	40	2	Mainly to Republic of Korea.
Pigments, mineral, iron oxides and hydroxides processed		43,306	43,818	4,709	China 25,864; Republic of Korea 4,510; Hong Kong 2,407.
Precious and semiprecious stones other than diamond:					
Natural	value, thousands	$8,589	$4,267	$370	Thailand $463; Australia $225; Other $1,083.
Synthetic	do.	$51,925	$52,779	$5,549	China $6,703; Hong Kong $6,034; Other $15,482.
Pyrite, unroasted		18	43	--	China 22; Hong Kong 6; New Zealand 6.
Quartz crystal, piezoelectric	value, thousands	$41,682	$43,146	$9,621	Singapore $12,598; Hong Kong $6,059; Philippines $2,919.
Salt and brine		1,562	1,074	23	China 301; Republic of Korea 256; Singapore 166.

See footnotes at end of table.

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TABLE 9--Continued
JAPAN: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2004	2005	Destinations, 2005: United States	Destinations, 2005: Other, principal
INDUSTRIAL MINERALS--Continued					
Stone, sand and gravel:					
Dimension stone:					
Crude and partly worked		37,259	52,864	7	Mainly to China.
Worked	value, thousands	$2,144	$2,185	$210	Republic of Korea $543; China $519; Ukraine $303.
Dolomite, chiefly refractory-grade		799	1,918	--	Thailand 20; Other 1,880.
Gravel and crushed rock		6,301	5,796	19	Republic of Korea 4,540; Bangladesh 141; Other 858.
Limestone other than dimension	thousand metric tons	2,994	3,317	--	Republic of Korea 850; Australia 556; Other 1,841.
Quartz and quartzite		4,237	3,558	2	Republic of Korea 1,009; Singapore 828; Germany 800.
Sand other than metal-bearing and sand and gravel		18,804	16,119	101	Indonesia 2,664; Thailand 1,358; Other 3,153.
Sulfur:					
Elemental:					
Crude including native and byproduct	thousand metric tons	1,160	1,263	--	China 895; Indonesia 138; Republic of Korea 136.
Colloidal, precipitated, sublimed		1,993	1,725	480	Indonesia 360; Italy 340; Mexico 240.
Dioxide		2	15	--	Mainly to China.
Sulfuric acid	thousand metric tons	1,158	1,378	40	China 722; Chile 164; Other 189.
Talc, steatite, soapstone, pyrophyllite		10,229	10,858	424	China 1,929; Singapore 1,864; Hong Kong 1,682.
Vermiculite, perlite, chlorite		20,194	14,256	117	Republic of Korea 12,709; Other 1,059.
Other: Slag and dross, not metal-bearing	thousand metric tons	7,704	8,312	498	Republic of Korea 1,241; United Arab Emirates 803; Other 2,646.

NA Not available. [r]Revised. -- Zero.

[1]Data presented in this table are from United Nations, Department of Economic and Social Affairs, Statistics Division.

[2]Includes waste and scrap.

[3]Less than 1/2 unit.

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TABLE 10
JAPAN: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2004	2005	Sources, 2005: United States	Sources, 2005: Other, principal
METALS					
Alkali and alkaline-earth metals		648	888	165	China 269; Russia 44; Germany 11.
Aluminum:					
Ore and concentrate		1,945,759	1,814,123	--	Australia 810,289; Indonesia 676,755; India 242,480.
Oxides and hydroxides		120,981	136,415	8,882	Australia 91,008; China 10,561; Republic of Korea 9,117.
Ash and residue		8,710	9,360	--	Indonesia 3,055; Thailand 2,998; Republic of Korea 1,462.
Metal, including alloys:					
Scrap		105,681	108,785	36,263	United Kingdom 13,259; Singapore 7,954; Saudi Arabia 8,078
Unwrought		3,021	2,977	8	Russia 748; Australia 562; China 319.
Semimanufactures		90,777	98,429	15,223	Republic of Korea 31,325; China 9,360; Germany 7,514.
Antimony:					
Ore and concentrate		10	50	--	China 40; Vietnam 10.
Oxides		7,977	7,855	(2)	China 6,998; Mexico 594; Other 183.
Metal, including alloys, all forms		8,176	7,435	--	China 7,413; Other 22.
Arsenic, metal, including alloys, all forms		20	22	--	China 20; Germany 2.
Beryllium, metal, including alloys, all forms		7	7	(2)	Republic of Korea 3; Thailand 3; China 1.
Bismuth		935	911	10	China 517; Peru 207; Belgium 101.
Cadmium, metal, including alloys, all forms		2,668	3,515	(2)	Republic of Korea 1,033; Canada 666; Mexico 573.
Chromium:					
Ore and concentrate		271,284	104,004	--	India 55,500; South Africa 26,108; Pakistan 12,390.
Oxides and hydroxides		4,196	4,474	96	China 2,653; Kazakhstan 720; United Kingdom 605.
Metal, including alloys, all forms		2,668	4,965	994	China 2,841; France 488; United Kingdom 377.
Cobalt:					
Ore and concentrate		10	63	--	Netherlands 29; China 15; United Kingdom 13.
Oxides and hydroxides		2,626	1,478	433	Belgium 352; Other 339.
Metal, including alloys, all forms		15,181	13,318	326	Finland 4,151; Australia 2,431; Canada 2,203.
Columbium (niobium) and tantalum, tantalum metal, including alloys, all forms		263	226	55	Thailand 92; China 30; Republic of Korea 14.
Copper:					
Ore and concentrate	thousand metric tons	4,457	4,320	57	Chile 1,939; Indonesia 825; Australia 428.
Matte, including cement copper		15,046	1,977	--	Vietnam 1,042; Malaysia 545; Other 390.
Oxides and hydroxides		2,618	2,907	2,159	Malaysia 227; Vietnam 201; Republic of Korea 100.
Sulfate		1,798	3,690	20	China 2,804; Thailand 202; Other 526.
Ash and residue containing copper		6,772	6,323	3,598	Malaysia 1,356; Indonesia 483; Philippines 411.
Metal, including alloys:					
Scrap		145,102	102,858	16,729	Philippines 17,489; Singapore 15,086; Thailand 14,672.
Unwrought		97,677	80,280	484	Chile 36,335; Peru 16,975; Republic of Korea 7,206.
Semimanufactures, all forms		82,724	86,318	2,787	Republic of Korea 24,770; China 21,058; Malaysia 13,450.
Germanium, metal, including alloys, all forms		9	22	(2)	China 17; Republic of Korea 3.
Gold, metal, including alloys, unwrought and partly wrought		80	80	11	Switzerland 32; Australia 18; Uzbekistan 6.
Iron and steel:					
Iron ore and concentrates	thousand metric tons	134,884	181,442	18,387	Republic of Korea 41,925; Thailand 12,190; Other 59,602.
Metal:					
Scrap	do.	261	181	18	Republic of Korea 42; Thailand 12; Other 60.
Pig iron, cast iron, related materials		693,736	1,159,396	8,407	China 880,108; Brazil 57,165; Other 68,892.
Ferroalloys:					
Ferrochromium		2,597 r	3,495	176	Thailand 288; Indonesia 34; Republic of Korea 25.
Ferromanganese		51,204	52,256	--	Australia 19,612; South Africa 13,590; China 12,134.
Ferromolybdenum		5,066	4,119	--	China 3,345; Chile 520; Republic of Korea 118.
Ferronickel		55,602	48,241	--	New Caledonia 32,044; Colombia 8,505; Dominican Republic 5,212.

See footnotes at end of table.

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TABLE 10--Continued
JAPAN: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2004	2005	Sources, 2005: United States	Sources, 2005: Other, principal
METALS--Continued					
Iron and steel--Continued:					
Metal--Continued:					
Ferroalloys--Continued:					
Ferrosilicochromium		4,230	2,160	--	All from China.
Ferrosilicomanganese		300,452	234,400	--	China 134,081; Ukraine 41,486; Republic of Korea 12,814.
Ferrosilicon		562,840	486,689	--	China 366,136; Brazil 64,993; Russia 31,926.
Ferrotungsten		1,329	1,529	--	China 1,508; Hong Kong 20; United Kingdom 1.
Silicon metal		242,442	222,851	410	China 191,223; Norway 13,513; Australia 6,744.
Lead:					
Ore and concentrate		140,716	171,606	81,953	Australia 64,308; Peru 10,968; Bolivia 6,076.
Oxides		21,802	11,410	27	China 4,144; Indonesia 1,821; Other 4,792.
Metal, including alloys:					
Unwrought		14,811	23,113	14	China 21,879; Mexico 942; Peru 258.
Semimanufactures		2,106	3,159	4	Republic of Korea 7,687; China 2,314; France 625.
Lithium, oxides and hydroxides:		1,497	1,503	1,318	China 133; Russia 45; New Zealand 8.
Magnesium, metal, including alloys:					
Scrap		1,620	458	--	Malaysia 81; China 49; Other 327.
Unwrought		42,130	35,528	16	Norway 34,192; China 33,395; Canada 1,226.
Semimanufactures		10,272	12,283	131	China 11,844; Russia 290; United Kingdom 6.
Manganese:					
Ore and concentrate	thousand metric tons	1,259	1,326	--	South Africa 833; Australia 382; Gabon 42.
Oxides and dioxides		10,441	15,796	30	South Africa 6,272; Australia 4,267; China 3,990.
Metal, including alloys, all forms		83,338	84,278	477	China 75,808; South Africa 7,846; United Kingdom 142.
Mercury		3	3	(2)	Mainly from Spain.
Molybdenum:					
Ore and concentrate:					
Roasted		35,462 r	265,749	14,611	Chile 142,217; Mexico 41,840; Canada 23,875.
Unroasted		110	117	112	Mainly from Australia.
Oxides and hydroxides		2,473	1,281	241	Uzbekistan 410; Chile 394; Netherlands 150.
Metal, including alloys, all forms		1,887	2,155	511	China 537; Germany 440; Austria 418.
Nickel:					
Ore and concentrate	thousand metric tons	4,513	4,757	--	Indonesia 2,218; New Caldonia 1,160; Philippines 1,379.
Matte		128,599	114,052	--	Indonesia 94,295; Australia 12,644; Philippines 6,857.
Oxides and hydroxides		258	130	11	Canada 81; Finland 37; China 1.
Metal, including alloys:					
Scrap		9,434	7,054	1,829	Russia 1,327; Republic of Korea 1,226; Other 642.
Unwrought		52,562	50,404	24	Norway 7,579; Russia 7,295; South Africa 7,057.
Semimanufactures		12,782	12,390	1,326	United Kingdom 4,525; Canada 4,336; Germany 582.
Platinum-group metals, including alloys, unwrought and partly wrought:					
Palladium	value, thousands	$482	$439	$61	South Africa $168; Russia $120; Germany $36.
Platinum	do.	$1,712	$1,774	$110	South Africa $1,393; Germany $78; Russia $67.
Rhodium	do.	$224	$577	$51	South Africa $392; United Kingdom $44; Russia $42.
Iridium, osmium, ruthenium	do.	$31	$36	$2	South Africa $29; Russia $1; United Kingdom $1.
Rare-earth metals, including alloys, all forms		6,379	8,387	(2)	China 8,384; Estonia 1.
Selenium		13	13	--	Philippines 10; Australia 1; Belgium 1.
Silicon, high-purity		10,981	13,003	7,631	United Kingdom 1,873; Germany 1,688; China 1,161.
Silver:					
Ore and concentrate		13,202	7,488	--	Chile 5,279; Peru 2,206; Republic of Korea 3.
Metal including alloys, unwrought and partly wrought		2,664	3,391	2,046	Republic of Korea 510; Mexico 260; Australia 221.

See footnotes at end of table.

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TABLE 10--Continued
JAPAN: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2004	2005	Sources, 2005: United States	Sources, 2005: Other, principal
METALS--Continued					
Tin, metal, including alloys:					
Scrap		128	266	--	Republic of Korea 152; Philippines 52; Thailand 32.
Unwrought		33,078	34,204	40	Indonesia 16,158; China 10,649; Malaysia 3,718.
Semimanufactures		1,386	1,493	3	Thailand 1,366; Malaysia 70; Republic of Korea 37.
Titanium:					
Ore and concentrate		450,287	509,797	--	Vietnam 156,352; Australia 148,145; India 66.
Oxides		15,211	13,091	66	China 6,435; Republic of Korea 4,326; France 617.
Metal, including alloys, all forms		6,940 r	5,948	1,702	Kazakhstan 1,485; Russia 1,408; Ukraine 345.
Tungsten:					
Ore and concentrate		134	3	--	All from Canada.
Metal, including alloys, all forms		1,474	2,222	558	China 1,183; Republic of Korea 224; Australia 66.
Uranium and thorium:					
Ore and concentrate		33	27	--	Malaysia 20; India 7.
Metal, including alloys, all forms		302	490	4	Canada 477; France 9.
Vanadium:					
Oxides and hydroxides		2,274	2,713	(2)	China 2,383; South Africa 290; Australia 40.
Metal, including alloys, all forms		316	288	187	Germany 100; China 1.
Zinc:					
Ore and concentrate	thousand metric tons	1,125	1,044	153	Australia 374; Peru 171; Bolivia 114.
Oxides		19,097	17,009	259	China 9,026; Republic of Korea 5,012; India 1,197.
Blue powder		2,231	3,298	--	China 1,537; Republic of Korea 1,326.
Ash and residue containing zinc		34,159	32,149	4,459	Republic of Korea 4,634; Iran 3,039; Other 13,484.
Metal, including alloys:					
Scrap		97	377	298	Philippines 51; Thailand 28.
Unwrought		44,386	48,547	20	Peru 18,580; China 13,177; Namibia 10,181.
Semimanufactures		11,302 r	12,251	12,251	China 7,861; Republic of Korea 2,020; Malaysia 633.
Zirconium:					
Ore and concentrate		67,915	78,020	1,732	Australia 47,318; South Africa 22,914; Russia 3,666.
Metal, including alloys, all forms		553	712	280	France 225; Australia 151; Republic of Korea 21.
INDUSTRIAL MINERALS					
Abrasives (not elsewhere specified):					
Natural, corundum, emery, pumice, etc.		14,937	14,995	662	India 7,488; China 5,234; Turkey 942.
Artificial:					
Corundum		172,958	155,586	346	China 121,992; Austria 10,078; Czech Republic 580.
Silicon carbide		86,141	94,532	257	China 88,941; Norway 1,975; Brazil 1,672.
Dust and powder of precious and semiprecious stones, including diamond	value, thousands	$3,499	$3,671	$3,544	China 32; Brazil 30; Switzerland 27.
Grinding and polishing wheels and stones		7,971	8,238	142	China 4,030; Thailand 3,184; Republic of Korea 204.
Asbestos, crude	value, thousands	$3,663	$101	--	Zimbabwe $81; Canada $15.
Barite and witherite		51,276	75,852	54	Mainly from China.
Boron:					
Crude natural borates		40,994	28,084	--	Mainly from Turkey.
Oxides and acids		50,568	54,721	22,518	Russia 25,144; Turkey 5,240; Chile 910.
Cement		841,114	951,328	420	Republic of Korea 873,805; China 57,595; France 17,522.
Chalk		1	114	--	All from Republic of Korea.
Clays, crude:					
Bentonite		215,815	203,749	159,034	China 42,340; New Zealand 854; United Kingdom 439.
Chamotte or dinas earth		12,234	11,543	--	Mainly from China.
Fire clay		6,056	3,333	1,464	Mainly from China.
Fuller's earth		11,063	12,857	4,902	Mainly from China.
Kaolin	thousand metric tons	1,275	1,276	827	Brazil 261; China 107; Indonesia 28.
Unspecified		158,729	148,362	6,019	China 128,549; South Africa 10,238; India 1,040.

See footnotes at end of table.

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TABLE 10--Continued
JAPAN: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2004	2005	Sources, 2005: United States	Sources, 2005: Other, principal
INDUSTRIAL MINERALS--Continued					
Diamond, natural:					
Gem, not set or strung	value, thousands	$1,154,675	$1,169,431	$51,946	India $478,856; Belgium $258,675; Botswana $21,644.
Industrial stones	do.	$10,086	$12,928	$2,307	Botswana $5,718; Belgium $1,766; United Kingdom $1,722.
Dust and powder	do.	$52,286	$44,650	$9,163	Ireland $21,377; China $4,430; Republic of Korea $3,794.
Diatomite and other infusorial earth		6,714	6,980	5,050	China 1,821; Mexico 36.
Feldspar		18,312	18,733	--	Republic of Korea 15,919; India 1,343; China 464.
Fluorspar	value, thousands	$61,198 r	$67,856	--	China $48,215; Mexico $18,277; Mongolia $366.
Fertilizer materials:					
Crude (note elsewhere specified)		32,756	34,025	9	China 16,066; Indonesia 12,070; Philippines 1,251.
Manufactured:					
Ammonia		234,459	215,619	(2)	Indonesia 187,530; Republic of Korea 28,020; Singapore 41.
Phosphatic		171,958	166,663	49,058	China 108,267; Republic of Korea 9,298.
Potassic		961,052	903,493	141,614	Canada 500,102; Russia 89,753; China 47,711.
Graphite, natural		178,112	171,110	402	China 166,001; Republic of Korea 2,137; Sri Lanka 1,300.
Gypsum and plaster	thousand metric tons	1,994	1,960	(2)	Australia 976; Thailand 975; Morocco 4.
Iodine		509	545	10	Mainly from Chile.
Lime		4,723	3,091	195	China 2,680; Indonesia 100; France 41.
Kyanite and related materials, mullite and unspecified		27,767	29,609	4,151	South Africa 10,229; China 3,784; Hungary 1,006.
Magnesium compounds:					
Magnesite, crude		7,107	6,847	--	China 6,600; Australia 200.
Oxides and hydroxides		611,479	578,228	435	China 547,493; Republic of Korea 15,991.
Other		3,289	5,679	--	Mainly from Germany.
Mica:					
Crude including splittings and waste		61,277	61,566	564	China 45,006; India 7,016; Canada 4,156.
Worked including agglomerated splittings		153	201	63	Belgium 35; United Kingdom 30; India 15.
Nitrates, crude		17,557	25,889	19	Mainly from Chile.
Phosphates, crude		820,572	774,297	--	China 387,333; Jordan 149,420; Morocco 111,930.
Phosphorus		31,602	31,481	--	China 30,906; Netherlands 482; Vietnam 50.
Pigments, mineral, iron oxides and hydroxides processed		23,244	20,078	327	China 11,674; Germany 4,766; Republic of Korea 1,216.
Precious and semiprecious stones other than diamond:					
Natural	value, thousands	$153,431	$154,974	$5,504	Thailand $48,666; Hong Kong $34,855; Australia $10,493.
Synthetic	do.	$21,516	$20,568	$9,755	China $2,771; Russia $3,132.
Pyrite, unroasted		9,951	33,823	--	China 28,233; Indonesia 5,590.
Quartz crystal, piezoelectric	value, thousands	$20,943	$15,899	$3,786	China $7,008; Thailand $3,483; Russia $610.
Salt and brine	thousand metric tons	8,066	8,302	3	Mexico 3,584; Australia 3,998; India 410.
Stone, sand and gravel:					
Dimension stone:					
Crude and partly worked	do.	105	88	6	China 23; India 12; Portugal 5.
Worked	do.	1,498	1,548	1	China 1,430; Italy 24; India 14.
Dolomite, chiefly refractory-grade	thousand metric tons	2,347	2,446	(2)	China 1,361; Philippines 565; Thailand 492.
Gravel and crushed rock		246,363	239,715	803	China 108,448; Philippines 28,820; Other 68,463.
Limestone other than dimension	thousand metric tons	340	294	1	Vietnam 135; Malaysia 98; China 38.
Quartz and quartzite		163,408	154,572	4,559	India 53,253; Republic of Korea 54,128; China 28,566.
Sand other than metal-bearing and sand and gravel	thousand metric tons	6,307	6,313	15	China 4,406; Australia 1,380; Other 284.

See footnotes at end of table.

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TABLE 10--Continued
JAPAN: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity	2004	2005	Sources, 2005: United States	Sources, 2005: Other, principal
INDUSTRIAL MINERALS--Continued				
Sulfur:				
Elemental:				
Crude including native and byproduct	1,672	1,626	--	Republic of Korea 1,052; China 574.
Colloidal, precipitated, sublimed	1,236	1,102	6	Republic of Korea 1,039; France 50.
Sulfuric acid	8,191 r	181	--	Mainly from Other.
Talc, steatite, soapstone, pyrophyllite	300,924	308,388	4,146	China 271,383; Australia 26,023.
Vermiculite, perlite, chlorite	230,772	264,775	301	China 244,806; South Africa.
Other: slag and dross, not metal-bearing	492,862	734,690	1,931	Republic of Korea 235,262; Canada 36,011; Other 09,078.

rRevised. -- Zero.
[1]Data presented in this table are from United Nations, Department of Economic and Social Affairs, Statistics Division.
[2]Less than 1/2 unit.

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THE MINERAL INDUSTRY OF NORTH KOREA

By John C. Wu

North Korea, which occupies the northern half of the Korean Peninsula, is located east of the Korean Bay and west of the Sea of Japan (the East Sea) between China and the Republic of Korea in East Asia. The country's total area is about 120,540 square kilometers, which is slightly smaller than that of Mississippi. As of July 2005, its population was about 22.9 million. Its economy remained tightly controlled and centrally planned by the North Korean Government. In 2005, North Korea's gross domestic product (GDP) and the GDP per capita based on purchasing power parity were estimated to be $40 billion and $1,800, respectively, and the country's real GDP growth was estimated to be 1% compared with 2.2% in 2004 (Bank of Korea, 2005§[1]; U.S. Central Intelligence Agency, 2005§). On the basis of North Korea's economic structure in 2004, the mining sector accounted for about 8.7% of North Korea's GDP (Bank of Korea, 2005§).

The country's identified important mineral resources are coal, copper, fluorspar, gold, graphite, iron ore, lead, limestone, magnesite, silver, tungsten, and zinc. Reserves of coal, iron ore, limestone, and magnesite are large by world standards. The country, however, has few reserves of natural gas and crude petroleum (National Intelligence Service of the Republic of Korea, 2004§; U.S. Library of Congress, 2005§).

In January 2005, the Government reportedly completed its 2004 geologic prospecting plan. Prospecting teams surveyed deposits of coal and iron ore and discovered potash, phosphate rock, and silica in the western part of the country. The North Hamgyong (Hamgyongbuk) Provincial Geological Prospecting Complex revised and updated its geologic survey data in the Musan area and delineated and confirmed the ore body (resources) of the Musan iron ore deposits using modern physical survey equipment. The North Pyongan (Pyonganbuk) Provincial Geological Prospecting Complex completed development of rare-earth mines and discovered natural mineral fertilizer in the area (Korea Central News Agency, 2005§).

To facilitate inter-Korea economic cooperation, which includes the expansion of Republic of Korea companies into the North Korean market, the Government of North Korea enacted the Inter-Korea Economic Cooperation Act in 2005. The Act, which is made up of 27 articles that are included in Government ordinance no. 1882 of the Presidium Supreme People's Assembly of July 6, was announced by the Government on July 29, 2005 (Ministry of Unification of the Republic of Korea, 2005b§).

On October 28, 2005, North Korea and the Republic of Korea opened their first joint office (Office of Inter-Korea Economic Cooperation) in an industrial park near Kaesong, which is located about 10 kilometers (km) north of the Demilitarized Zone, to promote trade through partnerships and direct deals across their border. The new office was staffed by 12 North Korean and 14 Republic of Korea economic officials to help businesses from both sides find partners and reach deals directly (North Korea Times, 2005§; Reuters, 2005§).

To cooperate on economic development between North Korea and the Republic of Korea, Korea Resources Corporation (Kores), which is a Republic of Korea state-owned natural resources development agency, announced in September 2005 that a liaison office would be set up in Pyongyang to handle mineral resource development. Kores indicated that it was engaged in talks with the North Korean Government to form a partnership for mineral-resource development projects that would focus on copper, iron ore, magnesite, and zinc. The Republic of Korea's Government would allow domestic private companies to join mineral-resource development projects in North Korea in the future through Kores-led consortia. The partnership negotiations on mineral-resource development projects included an initial $5.1 million project to mine graphite in Yonan County, South Hwanghae Province (Hwanghaenam-Do). By September 2005, Kores had constructed facilities for graphite mining, which was the first inter-Korean project in the mineral resource sector. The test operation of the facilities was carried out in November 2005. The graphite mine capacity was between 10,000 and 12,000 metric tons per year (t/yr). The graphite production would be shipped to the Republic of Korea beginning in 2006. The Republic of Korea state-owned Korea National Oil Corp. was seeking joint development of coal and oil resources as part of a large deal to expand bilateral cooperation (Chinadaily.com, 2004§; Korea Times, 2005§; Monstersandcritics.com, 2005§).

North Korea's mineral production included barite, coal, copper, fluorspar, gold, graphite, iron ore, lead, limestone, magnesite, phosphate rock, salt, silver, sulfur, talc, tungsten, and zinc. Production of processed minerals included cadmium, cement, coke, refined copper, ferroalloys, refined lead, magnesia clinker, nitrogen fertilizer materials, pig iron, steel, and refined zinc (table 1). In 2005, most of the country's mines and mineral-processing plants were still operated at below their design capacity because of outmoded facilities, a shortage of spare parts and energy (electricity and coking coal), and a lack of capital for renovation and modernization.

In 2005, North Korea's two-way trade totaled more than $3 billion compared with $2.86 billion in 2004. The increase in trade volume was largely owing to a 15% increase in trade with China to $1.58 billion in 2005. North Korea's trade with the Republic of Korea increased to $1.06 billion in 2005 from $697.04 million in 2004. North Korea's trade with Japan decreased to $195 million in 2005 from $253 million in 2004. In 2005, the main export commodities to China were marine products, minerals (coal and mineral ore), and steel; and the major imported commodities from China were cereals, meats, and mineral fuel (crude petroleum). The major export commodities to the Republic of Korea were agricultural and marine products, minerals, and steel and metal. The major import commodities from the Republic of Korea were

[1]References that include a section mark (§) are found in the Internet References Cited section.

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agricultural and marine products, electrical and electronic products, and machineries. The main export items to Japan were electrical machineries, marine products, and mineral fuels; and the major import items from Japan were artificial filament textiles, automobiles, and electrical machineries (Ministry of Unification of the Republic of Korea, 2005a§, d§).

To revitalize and modernize its mining sector, the Government had sought foreign investors to invest in North Korea's mining industry. In 2004, investment opportunities in the mining sector were revealed to participating foreign companies. Investment opportunities that were made known to Chinese investors included the Changdo barite mine, the Liwon mica mine, the Songcheon nonferrous metals mine (copper, nickel, lead, and zinc), and the renovation of previously operated coal mines; additional investment opportunities in the production of bronze, calcium carbide, diatomite, gold, lithium, molybdenum, and titanium were also revealed. Investment opportunities in the mining sector revealed to German investors included the Susan titanium (ilmenite) mine in South Hwanghae Province (Hwanghaenam-Do), the Kamuri nonferrous metals (copper, gold, molybdenum, and platinum) mining district in North Hwanghae Province (Hwanghaebuk-Do), and the Pyongsan fluorite mine in North Hwanghae Province (Korea Trade-Investment Promotion Agency, 2004§; Wolfgang Hampel Geological Consultant, 2004§).

The mining sector provided fuel and raw materials to the manufacturing sector and earned substantial amounts of foreign exchange. Production of coal and iron ore was mostly for domestic consumption by the utility and iron and steel industries, but certain amounts of coal and iron ore were exported to earn foreign exchange. Limestone production was for consumption by the domestic cement and construction industries. Magnesite production was for the production of magnesia clinker for consumption by the domestic metal-manufacturing industries and for export.

Coal (mostly anthracite) was produced mainly from the Anju, the Kaechon, the Pukchang, the Sunchon, and the Tockchon areas in South Pyongan Province (Pyongannam-Do) and from the Saebyol area in North Hamgyong Province (Hamgyongbuk-Do). According to statistics published by Korea International Trade Association of North Korea, earnings from coal exports to China increased by 120% to $136.7 million for the first 11 months of 2005 from the same period in 2004 (Ministry of Unification of the Republic of Korea, 2005e§). According to statistics released by China's Customs Bureau, during January-November 2005, China imported 23.16 Mt of coal, of which 2.272 Mt was from North Korea (AAAmineral.com, 2005§).

In 2005, China Minmetals Corp. reportedly signed an agreement with North Korea's Ministry of Foreign Trade to establish a joint venture to renovate and operate the Yongtung Coal Mine, which was North Korea's first joint venture with foreign companies in the sphere of resources outside the special zone. Yongtung Coal Mines, which was one of the leading coal mines in North Korea, produced about 1 Mt/yr of anthracite (CanKor, 2005§).

Iron ore was produced mainly from the Musan Mine, which is located in North Hamgyong Province (Hamgyongbuk-Do) along the Tumen River near the Chinese border, and from the Ullyul (Unryul) Mine in South Hwanghae Province. The Musan Mine, which was purported to be the largest iron ore deposit in Asia, was said to have estimated ore reserves of between 3 billion and 7 billion metric tons (Gt). In 2005, North Korean iron ore production totaled about 5 Mt, of which more than 1 Mt of iron ore and concentrate was exported to China compared with 600,000 metric tons (t) in 2004 (MCN International Pte Ltd., 2005§).

In November 2005, according to Asia Times, Tonghua Iron & Steel (Group) Co. Ltd., which was a mid-sized state-owned steelmaker based in Tonghua City, Jilin Province, in northeastern China, was expected to sign an $867 million 50-year exploration-rights deal with the Musan iron ore mine in North Korea. According to Tonghua Iron & Steel, the company hopes to receive 10 Mt/yr of iron ore from the Musan Mine as part of its plan to raise its steel production to a projected 5.5 Mt in 2007 and 10 Mt in 2010 from 2.5 Mt in 2004. According to Tonghua City local press reports, of the total investment of $867 million, about $248 million would be for infrastructure construction (transportation and power lines), and about $619 million, for equipment and technology for the mining project. Jilin's Yanbian Tianchi Stock Holding Co. and Sinosteel Corporation probably would join as partners in the project. The Musan Mine reportedly produced about 3 Mt/yr in recent years (Asia Times Online, 2005§; Metalsplace.com, 2005§; Resource Investor, 2005§; World Peace Herald, 2005§).

North Korea's nonferrous metals production reportedly had increased gradually to 98,000 t in 2004 from 94,000 t in 2003 and 87,000 t in 2002 after the Government introduced an incentive system through economic reform measures in 2003. The Komdok Mine in South Hamgyong Province (Hamgyognam-Do), according to an economic journal of the Republic of Korea, accounted for 60% to 70% of North Korea's lead and zinc production. The lead and zinc concentrates produced from the Komdok Mine were delivered to the Mungyong (Muncheon Geumgang) refinery near the town of Tancheon in South Hamyong Province. According to the same journal, despite a recent workforce increase at the mine to encourage increased output for export, the production in the past 2 to 3 years remained below capacity owing to a lack of electricity for electrolysis and the low grade of ore mined (Open Source Center, 2005§; Ministry of Unification of the Republic of Korea, 2006§).

Outlook

For the next 4 to 5 years, the North Korea mining sector will continue to be dominated by coal, iron ore, limestone, and magnesite. The coal and iron ore mining activities and their production are expected to increase because of China's investment in the Musan iron ore mine and in the Yongtung anthracite coal mine. Because of China's growing demand for minerals, its investment in North Korea's mining sector is expected to increase and to extend beyond coal and iron into other minerals, such as copper, gold, molybdenum, and nickel.

North Korea's real GDP growth is expected to increase gradually to between 2% and 3% during the next 2 years.

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TABLE 1
NORTH KOREA: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Commodity[3]		2001	2002	2003	2004	2005
METALS						
Cadmium metal, smelter		200	200	200	200	200
Copper:						
Mine output, Cu content		12,000	12,000	12,000	12,000	12,000
Metal:						
Smelter, primary and secondary		15,000 r	15,000 r	15,000 r	15,000 r	15,000
Refinery, primary and secondary		15,000	15,000	15,000	15,000	15,000
Gold, mine output, Au content	kilograms	6,600	6,600	6,300	6,000	6,000
Iron and steel:						
Iron ore and concentrate, marketable:						
Gross weight	thousand metric tons	4,200	4,100	4,430	4,580	5,000
Fe content	do.	1,200	1,150	1,260	1,300	1,400
Metal:						
Pig iron	do.	800	800	900	900	900
Ferroalloys, unspecified	do.	10	10	10	10	10
Steel, crude	do.	1,000	1,030	1,090	1,070	1,070
Lead:						
Mine output, Pb content		9,000	10,000	20,000	20,000	20,000
Metal:						
Smelter, primary and secondary		9,000	10,000	20,000	20,000	20,000
Refinery, primary and secondary		7,000	6,000	7,000	9,000 r	9,000
Silver, mine output, Ag content		20	20	20	20	20
Tungsten, mine output, W content		500	600	600	600	600
Zinc:						
Mine output, Zn content		60,000	60,000	60,000	62,000	67,000
Metal, primary and secondary		65,000	65,000	65,000	67,000	72,000
INDUSTRIAL MINERALS						
Barite		70,000	70,000	70,000	70,000	70,000
Cement, hydraulic	thousand metric tons	5,160	5,320	5,540	5,630	5,700
Fluorspar		12,000	12,000	12,000	12,000	12,500
Graphite		25,000	25,000	25,000	30,000 r	32,000
Magnesite, crude	thousand metric tons	1,000	1,000	1,000	1,200	1,200
Nitrogen, N content of ammonia	do.	100	100	100	100	100
Phosphate rock		350,000	300,000	300,000	300,000	300,000
Salt, all types		500,000	500,000	500,000	500,000	500,000
Sulfur	thousand metric tons	41	42	42	42	42
Talc, soapstone, pyrophyllite		60,000	50,000	50,000	50,000	50,000
MINERAL FUELS AND RELATED MATERIALS						
Coal:						
Anthracite	thousand metric tons	16,000	17,000	16,000	16,300	16,500
Lignite	do.	7,000	7,000	6,300	6,500	7,000
Total	do.	23,000	24,000	22,300	22,800	23,500
Coke	do.	2,000	2,000	2,000	2,000	2,000

r Revised.

[1] Table includes data available through April 28, 2006.

[2] Estimated data are rounded to no more than three significant digits; may not add to totals shown.

[3] In addition to the commodities listed, crude construction materials, such as sand and gravel and other varieties of stone, and refined petroleum products and rare earths presumably are produced, but available information is inadequate to make reliable estimates of output levels.

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TABLE 2
NORTH KOREA: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity		Main operating companies and main equity owners	Location of main facilities	Annual capacity[e]
Cement		Sunchon Cement Complex	Sunchon in Pyongannam Province	3,000
Do.		Samgwong Cement Complex	Samgwong in Kangwon Province	2,000
Do.		Gomusan Cement Factory	Cheongjin, Hamgyongbuk Province	2,000
Do.		Cheonnaeri Cement Factory	Cheonae in Hamgyongnam Province	1,000
Coal		Anju Coal Mining Complex and Sunchon Coal Mining Complex	Anju, Kaechon, Pukchang, Sunchon, and Tokechon all in Pyongannam Province	9,500
Do.		Saebyol Coal Mining Complex	Saebyol in Hamgyongbuk Province	6,000
Gold, mine output, Au content	kilograms	Kumsan (Gumsan) Joint-Venture Co.	Sierra near Changjin northwest of Hamhung, Hamgyongbuk Province	530
Iron ore, concentrate, gross weight		Ministry of Metal and Machines Industry, Department of Mines, Musan Iron Ore Mine Complex	Near the town of Musan, Hamgyongbuk Province	10,000
Do.		Unryul Mine	Unryul, Hwanghaenam Province	1,000
Lead:				
In concentrate		Korea Zinc Industrial Group	Komdok, near Tancheon, Hamgyongnam Province	20
Refined		do.	Munpyong, Kangwon Province	32
Magnesia clinker		Korea Magnesia Clinker Industry Group	Tanchon and Dae Hung, Hamgyongnam Province; Song Jin, Hamgyongbuk Province	1,150
Magnesite, concentrate, gross weight		do.	Dae Hung and Ryong Yang, Hamgyongnam Province Paek Bai near Kimchaek, Hamgyongbuk Province	2,500
Steel, crude		Ministry of Metal and Machines Industry:		
Do.		Kimchaeck Iron Works	Chongjin, Hamgyongbuk Province	2,400
Do.		Hwanghae (Hwanghai) Iron Works	Songnim, Hamgyongbuk Province	1,500
Do.		Kangson Works	Kangson, Hwanhaebuk Province	960
Do.		Chullima Steel Works	Nampo, Pyungnam Province	760
Zinc:				
In concentrate		Korea Zinc Industrial Group	Komdok near Tancheon and Sankok near Kowon, Hamgyongnam Province; Nakyong, Hwanhaenam Province	80
Refined		do.	Munpyong, Kangwon Province; Tancheon, Hamgyongnam Province	100

[e]Estimated; estimated data are rounded to no more than three significant digits.

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THE MINERAL INDUSTRY OF THE REPUBLIC OF KOREA

By John C. Wu

The Republic of Korea, which occupies the southern half of the Korean Peninsula below the 38th parallel, is located east of the Yellow Sea, west of the Sea of Japan (the East Sea), and between the Democratic People's Republic of Korea (North Korea) and Japan in Eastern Asia. The Republic of Korea's total area is about 98,480 square kilometers, which is slightly larger than Indiana. In 2005, the country's population was estimated to be 48.8 million. According to the International Monetary Fund, the Republic of Korea is a newly industrialized country in East Asia. Its gross domestic product (GDP) and the GDP per capita based on purchasing power parity were estimated to be $994.4 billion and $20,590, respectively, in 2005 compared with $934.2 billion and $19,429, respectively, in 2004 (International Monetary Fund, 2006§[1]; U.S. Central Intelligence Agency, 2006§).

According to Korea Resources Corporation (Kores), which is a state-owned company under the supervision of the Ministry of Commerce, Industry and Energy, the Republic of Korea has small reserves of antimony, copper, gold, iron ore, lead, molybdenum, silver, tin, tungsten, and zinc. The country's reserves of coal and offshore natural gas were also small. Reserves of such industrial minerals as kaolin, limestone, pyrophyllite, silica stone (quartzite), and talc, however, were larger than other identified minerals in Korea (Korea Resources Corporation, 2004, p. 117).

In 2005, the Republic of Korea was the world's fifth ranked steel producer and one of the world's leading producers of cadmium and slab zinc (World Bureau of Metal Statistics, 2006, p. 34, 129; International Iron and Steel Institute, 2006a§). The country was one of the major producers of cement, refined copper, pyrophyllite, talc, and zeolite in the Asia and the Pacific region and was one of the region's significant consumers and importers of coal, natural gas, and nickel oxide sinter; ores and concentrates of copper, iron, lead, and zinc; and crude petroleum. Because of its limited indigenous mineral resources, the Republic of Korea relied almost 100% on imports to meet its requirements for bituminous coal; ores and concentrates of copper, iron, lead, rare earths, and zinc; fluorite; natural gas; gypsum; magnesite; crude petroleum; phosphate rock; and uranium.

The mining and quarrying sector, which was the smallest sector of the Republic of Korea's economy, produced anthracite coal, ferrous and nonferrous metals, and industrial minerals. According to the Bank of Korea, the output of the mining and quarrying sector accounted for only 0.27% of the country's GDP in 2005. In 2005, the country's GDP in current prices was Won (W) 806,621.9 billion ($796.3 billion[2]), and in 2000 constant prices was W721,491.4 billion ($712.2 billion). The economy as measured by the real GDP in 2000 constant prices grew by 4.0% in 2005 owing mainly to a 7% growth in the manufacturing sector. The mining and quarrying sector had a negative growth rate of 1.5% in 2005 (Bank of Korea, 2006, p. 192).

Government Policies and Programs

On October 20, 2005, the Republic of Korea played host to the second meeting of the Asia-Pacific Economic Cooperation (APEC) Ministers responsible for mining in Gyeongju (Kyongju) near Pohang, which is about 350 kilometers (km) southeast of Seoul. With the theme "Towards the future of mining," the Ministers from 18 APEC member countries agreed to join forces to fight the major issues facing the mining sector and adopted the Gyeongju Joint Statement through which they agreed to make concerted efforts to enhance market transparency; facilitate mineral exploration, development, and trade; and promote sustainable development of mining. At the meeting, the participants established a common view on the need for the following: active information sharing to ensure market transparency, the removal of trade barriers to facilitate trade, enhanced cooperation between the public and private sectors to promote and facilitate mineral exploration and development, and increased technology cooperation on resources development. At the end of the meeting, the Ministers agreed to establish the APEC Forum on Energy and Mining to promote information exchange between the APEC business sector and the Government, to enhance the database of mineral-related information on member economies, and to promote environmentally friendly resource development and technology cooperation to prevent mining pollution (Korea.net, 2005§).

At the meeting of the APEC Forum on Energy and Mining in Gyeongju, the Republic of Korea proposed that APEC members take part in inter-Korea projects to develop mines in North Korea. The Republic of Korea said that cooperation between the Republic of Korea and North Korea could combine the Republic of Korea's capital and technology with the North Korea's rich natural resources, such as gold, iron ore, magnesite, and silver, and recommended that the APEC members take part in joint resources development in North Korea (Agence France Presse, 2005).

According to the Republic of Korea's Ministry of Unification, the Republic of Korea and North Korea reached agreement in July 2005 on a new way of undertaking economic cooperation projects. Under the new agreement, the Republic of Korea and North Korea will combine their assets, such as resources, capital, and technology, to balance the development of their national economies. Under the agreement, the Republic of Korea will provide North Korea with raw materials for the production of daily goods, such as clothes, shoes, and soap, and North Korea will guarantee the Republic of Korea's investment and production of such mineral resources as coal, magnesite, and zinc (Yonhap News, 2005§).

[1]References that include a section mark (§) are found in the Internet References Cited section.

[2]Values have been converted from Korean Won (W) to U.S. dollars (US$) at a rate of W1,013.0 =US$1.00 in 2005.

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To promote trade through partnerships and to enable businesses to deal directly across their mutual border, the Republic of Korea and North Korea opened their first joint office of Inter-Korea Economic Cooperation near Kaesong, which is located about 10 km north of the Demilitarized Zone, on October 28, 2005. The new office was staffed by 14 economic officials from the Republic of Korea and 12 from North Korea (Reuters, 2005§).

Production

The Republic of Korea's mine production of metallic minerals included mainly gold, iron ore, and silver. Mined production of copper, lead, and zinc was very small. The mine production of industrial minerals included barite (no production in 2005), diatomite, feldspar, graphite, kaolin, limestone, mica, pyrophyllite, quartzite, salt, sand, talc, and zeolite. The country also produced anthracite coal and a small amount of natural gas from an offshore gasfield, but no crude petroleum. In 2005, mine production of metallic minerals was very small. The mine production of most industrial minerals except pyrophyllite, talc, and zeolite, declined. In 2005, anthracite coal production decreased by 9.5% to below 3 million metric tons (Mt) for the first time in the post-World War II period.

The Republic of Korea manufactured large quantities of iron and steel and refined petroleum products using entirely imported raw materials, and moderate quantities of nonferrous metals, including bismuth, cadmium, copper, gold, lead, nickel, and zinc, also using mostly imported raw materials. In 2005, metal production of copper, gold, lead, silver, and crude steel increased, and that of pig iron, nickel, and zinc decreased. Manufactured cement, for which mostly domestic raw materials were used, decreased by10% to 51.4 Mt in 2005 because of reduced domestic demand, and production of refined petroleum products increased by 4% to 922.6 Mbbl in 2005 because of increased overseas demand (exports) (table 1).

Trade

In 2005, the Republic of Korea's total exports increased by 12% to $284.4 billion owing mainly to a 13.6% increase in exports of heavy industry products to $236.2 billion, which included mainly chemicals, electric and electronic machinery, industrial machinery and precision equipment, iron and steel products, passenger cars, and ships and boats. The country's total imports increased by 16% to $261.2 billion owing mainly to a 24.2% increase in imports of crude materials and fuels to $141.4 billion; these imports included mainly chemicals, fuels, iron and steel products, light industrial crude material, minerals, and nonferrous metals (Bank of Korea, 2006, p. 114-115).

In minerals trade, the Republic of Korea was a net importer of mineral commodities owing to its large imports of coal, natural gas, and crude petroleum; iron ore and ore and concentrates of copper, lead, and zinc; and ferrous and nonferrous metal products. In 2005, imports of fuels totaled $66.5 billion, of which $42.6 billion was crude petroleum. Imports of iron and steel products totaled $13.3 billion. Imports of minerals, which included iron ore and ore and concentrates of copper, lead, zinc, and other minerals, totaled $9.4 billion. Imports of nonferrous metals totaled $8.6 billion. Exports of crude materials and fuels totaled $18.7 billion, of which $15.5 billion was refined petroleum products. Exports of iron and steel products totaled $22.5 billion (Bank of Korea, 2006, p. 114-116).

Structure of the Mineral Industry

The Republic of Korea's mining and quarrying sector consisted of small mining industries of coal and ferrous and nonferrous metals and a relatively larger industry of industrial minerals. The mineral-processing sector, which consisted of cement, ferrous and nonferrous metals, and refined petroleum products industries, was much larger than the mining and quarrying sector (table 2). The mining and quarrying sector employed about 10,750 workers, of which about 6,600 were coal miners; about 4,010, industrial minerals miners; and about 140, metallic minerals miners. Most of the mining, quarrying, and ferrous and nonferrous metal processing companies were owned and operated by private companies incorporated in the Republic of Korea. The larger coal mining, natural gas, petrochemical, and petroleum refining companies, however, were state-owned and under the supervision of the Ministry of Commerce, Industry and Energy (Korea Resources Corporation, 2004).

In 2005, LS-Nikko Copper Inc. (formerly LG-Nikko Copper Inc.) completed its expansion of copper refining capacity to 510,000 metric tons per year (t/yr) from 450,000 t/yr in 2004 in Onsan. LS-Nikko Copper also raised its refined-silver production capacity to about 370,000 kilograms per year (kg/yr) in 2005 from 330,000 kg/yr in 2004 in Onsan (Korea Nonferrous Metal Association, 2006).

Commodity Review

Metals

Aluminum.—Korea relied entirely on imports to meet its requirements for primary aluminum. In 2005, imports of primary aluminum increased by 2.8% to 1,230,643 metric tons (t), of which 985,220 t was primary aluminum ingot, and 245,423 t, primary aluminum alloys. The major suppliers of primary aluminum ingots and alloys were China (41.9%), Russia (24.3%), Australia (16.9%), South Africa (4.9%), the United Arab Emirates (4.1%), and Canada (2.9%). The country also imported about 298,200 t of aluminum and aluminum alloy scrap in 2005 (World Bureau of Metal Statistics, 2006, p. 25).

Domestic demand for primary aluminum increased by 3.8% to 1.2 Mt, of which primary aluminum ingot increased by 5.1% to 978,500 t but primary aluminum alloys decreased by 3.1% to 203,600 t. The major consumers were the manufacturers of aluminum sheet, plat, and coil; aluminum extrusion; aluminum foil; aluminum wheels for automobiles and other casting products; and aluminum metal powders (Joo Ho Kim, Vice Chief, Korea Nonferrous Metal Association, written commun., June 8, 2006). In 2005, Korea exported 42,151 t of aluminum alloys, 16,347 t of aluminum scrap, and 6,449 t of primary aluminum. The major buyers were China and Japan (World Bureau of Metal Statistics, 2006, p. 25).

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Copper.—Mined production of copper was very small and insignificant compared with the country's requirements for copper ore and concentrate, which amounted to about 1.4 Mt in 2005. The Republic of Korea was the fourth leading producer of refined copper after China, Japan, and India in the Asia and the Pacific region. The country relied on imports of copper ore and concentrate to meet the raw material requirements for its copper smelters, which were located in Changhang and Onsan. In 2005, the Republic of Korea imported about 1.4 Mt of copper ore and concentrates, which was valued at about $1.73 billion (Ministry of Commerce, Industry and Energy, 2006, p. 310).

In 2005, the Republic of Korea's copper smelters produced about 475,900 t of blister and anode copper (International Copper Study Group, 2006, p. 13). To meet raw material requirements for the Changhang and the Onsan copper smelters and refineries, the country also imported 32,752 t of blister and anode copper and 205,945 t of copper and copper alloy scrap in 2005. The Republic of Korea produced about 520,000 t of refined copper. To meet the domestic refined copper requirements, the country also imported about 428,049 t of refined copper and about 920 t of copper alloys (World Bureau of Metal Statistics, 2006, p. 71).

In January 2005, the joint venture of Chariot Resources Ltd. of Canada and LS-Nikko Copper Inc. (formerly LG-Nikko Copper Inc.) and Korea Resources Corporation of the Republic of Korea formally acquired the Marcona copper project, which is located about 500 km south of Lima from Rio Tinto plc and Shougang Hierro Peru S.A.A. The cost was $33.5 million plus up to an additional $10 million if the known mineral resources at the time of mining are larger than the 2004 estimated inferred mineral resources. Under an agreement reached in 2004, the Marcona copper project was 70% owned by Chariot Resources and 15% each by Korea Resources and LS-Nikko Copper (Chariot Resources Ltd., 2005§).

According to the Ministry of Commerce, Industry and Energy, about 200 Mt of new copper resources reportedly were discovered in 2005 at the Marcona copper project, where about 218 Mt of copper resources already had been found. As a result of this new discovery, Chariot Resources, Korea Resources, and LS-Nikko Copper reportedly would start development of the Marcona copper mine; production was planned to begin in the third quarter of 2009. The Ministry indicated that this newly discovered resource would help the Republic of Korea secure a more stable supply of copper in a time of surging copper prices (Metals Place, 2005a§).

Domestic demand for copper cathode decreased by 8.7% to 822,518 t from 901,099 t in 2004. Exports of copper cathode, however, increased sharply by 86.5% to 86,069 t from 46,145 t in 2004, and imports of copper cathode decreased by 14.3% to 390,230 t from 455,190 t in 2004. In the domestic market, most copper cathode was consumed by the manufacturers of brass, cable, plates, sheet, strip, tube, and wire. In 2005, the major manufacturers of copper rod for electric wire, copper and copper alloy sheet, strip, pipe, and tube were Daechang Industrial Co. Ltd., Lee Ku Industrial Co. Ltd., and Poongsan Corp. (Korea Nonferrous Metal Association, 2006, p.1).

Gold.—According to Korea Institute of Geoscience and Mineral Resources, mined production of gold increased by 14% to 265.7 kilograms (kg) from 233.3 kg in 2004 (Choi, Gurl, Senior Researcher, Mineral Economics Team, Korean Institute of Geoscience and Mineral Resources, written commun., June 11, 2006). Mine production of gold was by Ivanhoe Mines Ltd. of Canada at the Silver Hill Mine (Seongsan-Eunsan) in South Cholla Province (Chollanam Do) in the southwest part of the Republic of Korea. The Eunsan prospect is a low-sulphidation epithermal gold-silver prospect estimated to contain inferred resources of 251,800 t of ore at grades of 15 grams per metric ton (g/t) gold and 83.8 g/t silver (Ivanhoe Mines Ltd., 2002§).

CanAustra Resources Inc. of Canada, which acquired a skarn gold prospect in Korea in 2004, announced in March 2005 that it was to conduct an exploration program at the Geodo project, which is located about 10 km from Taebaeck City in Kangwon Province. The exploration program included a systematic surface exploration across the known skarn outcrop to delineate zones with known anomalous gold-copper-silver and to identify new zones. A detailed review of the past data followed by drill testing of anomalous zones was to be conducted to determine the width and grade of the identified system, and additional drilling would be done to establish size constraints at the Geodo prospect. According to the company, grab samples from the site have yielded a range of values that suggest the presence of massive to disseminated mineralization over a combined strike of more than 5,000 meters in length and a width of several tens of meters. In addition, high grade zones and veins occur on the property and were possibly enriched in the retrograde phase of mineralization. In August 2005, the company consolidated its share capital on a basis of two old shares for every one new share, and the name of the company was changed to Oriental Minerals Inc. from CanAustra Resources Inc. (ArriveNet.com, 2005§).

According to the Ministry of Commerce, Industry and Energy, Korea produced 42,485 kg of refined gold in 2005, of which 1,853 kg was produced from domestic raw materials, which included scrap. In 2005, domestic demand for refined gold decreased by 13.4% to 78,889 kg; imports of refined gold dropped sharply by 78.9% to 56,742 kg, which was valued at $804.5 million; exports of refined gold also dropped sharply by 91.4% to 19,935 kg, which was valued at $262.3 million (Ministry of Commerce, Industry and Energy, 2006, p. 278, 288, 300, 310). The major end users of refined gold were the manufacturers of coins, dental products, electrical communication parts, jewelry, materials for semiconductors, and other uses.

Iron and Steel.—The Republic of Korea relied 99.5% on imports to meet its iron ore requirements in 2005. Imports of iron ore totaled 43.46 Mt and were valued at about $1.93 billion. In 2005, Australia and Brazil were the two dominant suppliers and accounted for 60% and 31%, respectively, of total iron ore imports. Other important suppliers of iron ore were Chile, India, and South Africa. The average import price of iron ore rose by 42.4% to $44.37 per metric ton from $31.15 per metric ton in 2004 (Ministry of Commerce, Industry and Energy, 2006, p. 310).

To secure a long-term stable supply of iron ore, Pohang Iron and Steel Co. Ltd. (POSCO) signed a 10-year (from April 2007

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to March 2017) purchase contract with two leading Australian iron ore producers—Hamersley Pty Ltd (100% owned by Rio Tinto plc) and Robe River Associates (53% owned by Rio Tinto plc)—on August 25, 2005, for the supply of a total of 128 Mt of iron ore over 10 years (Metals Place, 2005b§; Rio Tinto plc, 2005§). POSCO also invested in Murchison Metals Ltd. of Australia, reportedly acquiring an initial 5.5% equity interest in Murchison in September 2005 for $3 million, which was equal to 10 million shares and 30 million options at an exercise price of 50 cents per share. POSCO's equity interest can increase to 12% and could eventually reach the target 19.9% when more options are exercised, which would enable POSCO to secure a directorship on Murchison's Board of Directors. Through this equity participation, POSCO reportedly had secured the right to buy up to 10 Mt/yr of iron ore during 25 years from Murchison, which owns the Jack Hill iron ore deposit, which is located east of Meekatharra in Western Australia. The Jack Hill mine was expected to begin iron ore production within the first three months of 2006 (Southeast Asia Iron and Steel Institute, 2005a§).

In June 2005, POSCO signed a memorandum of understanding (MOU) with the government of the State of Orissa, India, to invest a total of $12 billion to build a 12-Mt/yr-capacity four-blast-furnaces steel plant in Paradip and for an iron ore project in Orissa. The steel plant was slated to begin production by June 2010. Under the agreement, POSCO was to export up to 30% of the iron ore from the iron ore mine that the State of Orissa planned to lease (Southeast Asia Iron and Steel Institute, 2005b§).

In 2005, the iron and steel industry consumed 43.66 Mt of iron ore and produced about 27.3 Mt of pig iron. For crude steel production, according to the Korean Iron and Steel Association, the industry also consumed about 27.6 Mt of ferrous scrap in 2005 compared with 25.9 Mt in 2004. About 7.3 Mt of the ferrous scrap consumed in 2005 was imported. Crude steel production reached a record-high level of 47.8 Mt in 2005, of which about 63.8% was produced by POSCO; 17.6%, by Hyundai INI Steel Co.; 5.7%, by Dongkuk Steel Mill Co.; 2.2%, by Korea Iron and Steel Co.; and the remaining 10.7%, by more than 7 other smaller steel companies (Ministry of Commerce, Industry and Energy, 2006, p. 278; TEX Report, The, 2006b).

In 2005, the Republic of Korea was the world's fifth ranked steel-producing country. The country's crude steel output accounted for about 4.22% of the world's total in 2005. The Republic of Korea's two leading steelmakers—POSCO, which produced about 30.2 Mt, and Hyundai INI Steel Co. Ltd. (or INI Steel Co. Ltd.), which produced about 8.2 Mt, were the world's 4th and 31st ranked steel-producing companies, respectively, in 2005 (International Iron and Steel Institute, 2006b§). According to a report by the Korea Iron and Steel Association, because of a steady expansion in the country's automobile, electronic, and shipbuilding industries in recent years, the per capita steel consumption had reached 969 kg and ranked as the world's highest followed by Taiwan, with 944 kg, and Japan, with 613 kg in 2005 (Digital Chosun, 2006§).

In December 2005, POSCO announced that it would invest about $157 million to raise the output of high-grade steel products from its Pohang Works. The investment would be made during the period between January 2006 and October 2007 and would enable the company to expand the output of high-grade steel by 300,000 t/yr. The company also stated that its integrated steel works in the State of Orissa, India, would have a capacity of 4 Mt/yr during the first phase, which was expected to be completed by 2010. In June 2005, POSCO signed an agreement to build a 12 Mt/yr steel plant in Orissa (Southeast Asia Iron and Steel Institute, 2005c§).

According to Korea Iron and Steel Association, the Republic of Korea's domestic demand for steel was estimated to be 46.93 Mt in 2005 and was projected to grow by 1% to 47.4 Mt in 2006 because of the growing demand of the automobile, machinery, and shipbuilding industries. Exports of steel products were projected to increase by 3.1% to 16.5 Mt in 2006, and imports of steel products from China, to decrease by 0.7% to 18.7 Mt in 2006. In past years, imports of steel products had been rising because of low-priced Chinese imports and a backlog of inventories. The association stressed that the Republic of Korea's iron and steel industry was expected to produce more value-added products and to quickly establish an advance sales system in 2006 to prevent a possible increase in Chinese imports (Metals Place, 2005c§).

Nickel.—The Republic of Korea relied 100% on imports to meet its nickel requirements. In 2005, the country imported 126,147 t of ferronickel (in gross weight), 41,580 t of refined nickel, 38,631 t of nickel oxide sinter (in gross weight), and 4,520 t of nickel powder and flake. The major suppliers of nickel oxide sinter, which contained 75% to 76% nickel, were Japan (56.1%), Australia (15.6%), Russia (14.0%), and Canada (12.9%). The major suppliers of refined nickel were Australia (47.4%), Russia (28.1%), Canada (10.5%), and Norway (3.2%) (World Bureau of Metal Statistics, 2006, p. 116).

Korea Nickel Corp., which was a joint venture of Korea Zinc Co. Ltd. (56%), Inco Ltd. of Canada (25%), and POSCO Steel Services and Sales Co. Ltd. (19%), was the sole nickel refining company in Korea. The combined capacity of Korea Nickel's two nickel refineries in Onsan was 48,000 t/yr of utility nickel, which contained 97% nickel. The older plant (16,000 t/yr capacity) had not been in operation since 1999. The newer plant (32,000 t/yr capacity) was completed and began operations in October 1999. Both plants used imported nickel oxide sinter as raw material (Korean Nonferrous Metal Association, 2006).

Demand for nickel ingot in the domestic market decreased by 3.7% to 116,260 t. Nickel ingot exports decreased by 41.9% to 1,368 t in 2005. On the supply side, the supply of nickel ingot from domestic sources decreased by 3.5% to 27,130 t; the supply of refined nickel from imports also decreased by 3.5% to 42,562 t and ferronickel from imports, by 5.8% to 47,936 t (in nickel content) (Korea Nonferrous Metal Association, 2006).

Zinc.—The Republic of Korea relied on imports for almost all the raw materials requirements for its zinc-refining industry. In 2005, imports of zinc ore and concentrate, in gross weight, increased by 2.4% to 1,283,183 t and were valued at $584.0 million. The three dominant suppliers were Australia (47.8%), the United States (19.1%), and Peru (13.3%). In 2005, consumption of zinc ore and concentrate decreased by 1.5% to 1,250,366 t (Ministry of Commerce, Industry and Energy, 2006, p. 278, 310).

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In 2005, production of zinc slab decreased by 3.6% to 645,000 t, of which 409,400 t was produced by Korea Zinc Co. Ltd. at Onsan, and 235,600 t, by Young Poong Corp. at Sukpo. A worldwide shortage of raw materials in 2005 that limited the supply of zinc ore and concentrate resulted in a decline in Korea's overall production of slab zinc. Korea Zinc remained one of the world's leading producers of slab zinc in 2005, however, and produced about 900,000 t of slab zinc from its plants in Korea and from its wholly owned subsidiaries—Sun Metals Corp. Pty., Ltd. in Australia and Big River Zinc Corp. in the United States (Korean Zinc Co. Ltd., 2006§).

Domestic demand for primary zinc (including unwrought zinc and zinc alloys, zinc bars, and rods, and other primary zinc products) increased by 8.0% to 422,838 t in 2004. In 2005, exports of primary zinc dropped by 15.9% to 315,083 t, and imports of primary zinc decreased by 16.1% to 91,890 t (Korea Nonferrous Metal Association, 2006).

Industrial Minerals

Cement.—The Republic of Korea was the world's fifth ranked cement producer after China, India, the United States, and Japan. Portland cement production decreased by 10% to 51.39 Mt from 56.96 Mt in 2004 because of weaker domestic demand that resulted mainly from a further decline in construction of private dwellings and commercial buildings in 2005 (Korea Development Bank, 2006, p. 185). Production of clinker decreased to 43.3 Mt from 48.3 Mt in 2004. Exports of clinker increased sharply to 1.9 Mt from 1.4 Mt in 2004. Exports of cement also increased sharply to 4 Mt from 2.6 Mt in 2004. The country did not import any clinker in 2005 but imported 3.4 Mt of cement in 2005 (Korea Cement Industrial Association, 2006§).

The country's cement industry comprised 11 companies that operated 51 kilns at 12 kiln plant sites and 26 grinding plants. The industry's total capacity was 70.2 Mt/yr. The industry's total number of employees was about 7,300 (Korea Cement Industrial Association, 2006§). During the period from 2000 through 2003, the country's per capita cement consumption trended upward from 1,021 kg in 2000 to 1,217 kg in 2003 because of the continued growth in private housing construction; beginning in 2004, however, the per capita cement consumption trended downward from 1,130 kg in 2004 to about 950 kg in 2005 owing to the slowdown in new construction of private dwellings and commercial buildings (Bank of Korea, 2006, p. 150).

Mineral Fuels

Coal.—Anthracite coal production decreased by 12.5% in 2005 as the Government continued to restructure the country's coal industry. The ongoing coal industry restructuring program was carried out under the Coal Mining Industry Act of 1988, which subsidized a portion of the expenses for mine closure. The Government, however, continued to support the relatively more-efficient coal mines with funds to modernize their facilities and revamp their development methods. To balance the supply and demand for domestic coal, the Government constructed two anthracite coal-fired powerplants with a combined capacity of 400,000 kilowatts (kW) between 1989 and 1999 (Korea Resources Corp., 2004, p. 35).

In 2003 (the latest year for which data were available), a total of nine coal mines operated, six of which were privately owned, and three, state-owned; about 37% of coal was produced by the state-owned companies, and 63%, by privately owned companies. To meet the country's coal requirements mainly for the cement, iron and steel, and utility industries in 2005, the Republic of Korea imported 4.6 Mt of anthracite coal valued at $429.0 million from China (59.7%), Australia (28.4%), and Vietnam (7.8%); 16.1 Mt of coking coal valued at $1.8 billion from Australia (57.2%), Canada (23.1%), China (11.3%), the United States (4.9%), and Russia (2.9%); and 56.1 Mt of thermal (steam) coal (of which about 95% was bituminous coal) valued at $3.1 billion from Australia (36.7%), China (29.0%), Indonesia (27.4%), and Russia (5.4%). Coal imports totaled 76.76 Mt and were valued at $5.3 billion compared with 78.97 Mt valued at $4.2 billion in 2004 (TEX Report, The, 2006a, c).

In 2005, demand for coking coal by the country's iron and steel industry was estimated to be about 16.3 Mt, of which 16.1 Mt was imported. The total demand for steam coal (mainly bituminous coal) was estimated to be 74 Mt in 2005, of which about 10 Mt was consumed by the cement industry; 44 Mt, by the utility (electricity-generating) industry; and 20 Mt, by the iron and steel industry (Korea Resources Corporation, 2004, p. 49).

Natural Gas and Petroleum.—The Republic of Korea began producing a small amount of offshore natural gas from the Donghae-1 field at the rate of about 2.124 million cubic meters per day in November 2004. In March 2005, the state-owned Korea National Corp. (KNOC) announced that it had discovered new gas reserves estimated to contain about 1.13 billion cubic meters in a gasfield located about 5 km southwest of the Donghae-1 gasfield, which is located 58 km offshore Ulsan along the country's east coast. According to KNOC, the new discovery could support production of 800,000 t of liquefied natural gas (LNG). In 2005, the Republic of Korea was the world's second ranked importer of LNG. The country relied on imports of LNG to meet most of its natural gas requirements (Platts.com, 2005§). In the energy-supply mix, the natural gas share increased to 12.9% in 2004 from just 3.2% in 1990, although Korea's imports of LNG decreased only slightly to 21.9 Mt or 32.8 billion cubic meters in 2005 from 22.2 Mt or 33.2 billion cubic meters in 2004 (Petroleum Economist, 2006).

In 2005, the Republic of Korea consumed about 31.6 billion cubic meters of natural gas, of which about 29.89 billion cubic meters in the form of LNG were imported mainly from, in decreasing order of amount imported, Qatar, Indonesia, Malaysia, and Oman, and a smaller amount from Australia and Brunei (Hydrocarbon Engineering, 2005§; U.S. Energy Information Administration, 2006§). According to Korea Gas Company (KOGAS), under the 7th long-term natural gas supply and demand plan, which was announced by the Ministry of Commerce, Industry and Energy in January 2005, natural gas demand was projected to grow at an annual average rate of 3.93% to reach 31.7 Mt, or 47.4 billion cubic meters, in 2017; city gas (residential gas) demand was projected to grow at an annual average rate of 5.36% to reach 24.9 Mt, or 37.3 billion

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cubic meters, in 2017; and power generation demand was projected to growth at an annual average rate of 0.32% to reach 6.8 Mt, or 10.1 billion cubic meters, in 2017 (Korea Gas Company, 2005§).

To secure additional supply of LNG at lower prices, the state-owned KOGAS signed 20-year sales and purchase contracts worth nearly $20 billion with Malaysia LNG Tiga (1.5 Mt/yr), Russian Sakhalin Energy (1.5 Mt/yr), and Yemen LNG (1.3 Mt/yr) for supplies of LNG beginning in 2008. KOGAS reportedly also was negotiating an additional 3 to 5 Mt/yr of LNG with potential sellers (Petroleum Economist, 2006).

The Republic of Korea produced no crude petroleum and imported all crude petroleum requirements for its oil refining industry. In 2005, the country imports of crude petroleum increased by 2.1% to 843.2 million barrels (Mbbl) [an average of 2.31 million barrels per day (Mbbl/d)], of which 81.8% was from the Middle East region, and 13.3%, from the Asia region. Crude petroleum dependence on the Middle East region in 2005 was the highest since 1981 when the country's oil dependence on the Middle East reached 90.7%. In 2005, the major suppliers of crude petroleum in the Middle East were Saudi Arabia (29.6%) and Kuwait (23.2%). Indonesia was the major supplier of crude petroleum in the Asia region (Petronet, 2005§).

Demand for crude petroleum in 2005 averaged 2.17 Mbbl/d compared with 2.14 Mbbl/d in 2004. In 2005, the Republic of Korea was the ninth ranked crude petroleum consumer and the fifth ranked net crude oil importer in the world (U.S. Energy Information Administration, 2006§). Because of its total dependence on oil imports, the country had developed a strategic petroleum reserve managed by KNOC. According to the Ministry of Commerce, Industry and Energy, the strategic stockpile normally maintained a 90-day supply of petroleum products at a ratio of 90% crude and 10% refined. Because of concerns over high oil prices, however, the Government planned to raise its strategic oil stockpile to 135 days of supply by 2008. As of February 28, 2005, the strategic oil stockpile totaled 143.738 Mbbl, which is equivalent to 105 days of supply, of which KONC held 53 days; the remaining 52 days of supply was held by 28 private energy companies, which included 5 refineries, 2 LNG importers, petrochemical companies, and refined products importers (Schlumberger, 2005§).

In a concerted effort to stabilize the world's oil market in the wake of the Hurricane Katrina disaster, the Government released 2.88 Mbbl of its strategic petroleum reserve in September 2005. The action was in response to a call by the International Energy Agency for its 26 member countries to release 2 Mbbl/d for 30 days starting in mid-September. According to the Ministry of Commerce, Industry and Energy, the Republic of Korea released its reserves before September 15. The Republic of Korea's share of 2 Mbbl/day was 96,000 bbl/d (Korea Times, The, 2005§).

Outlook

During the next 2 years, the country's mining sector is expected to hold steady; in the mineral processing sector, however, the iron and steel industry is expected to expand. The country is expected to continue its active involvement in joint-venture exploration and development of mineral resources, which included coal, copper, lead, zinc, and other nonferrous metals as well as oil and gas in the Eurasian, Latin American, and Southeast Asian countries.

The country's economy as measured by the GDP is projected to grow at a slightly faster pace of 5.5% in 2006 and then to slow down to 4.5% in 2007. The country's inflation was forecasted to be between 2.5% and 3% during the next 2 years (International Monetary Fund, 2006§).

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TABLE 1

REPUBLIC OF KOREA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2001	2002	2003	2004	2005
METALS						
Bismuth, metal		106	69	120	156	231
Cadmium, smelter		1,879	1,825	2,175	2,362	2,582
Copper:						
Mine output, Cu content		--	--	--	7 r	16
Metal:						
Smelter, primary and secondary		428,500	430,000	460,000	430,000	475,900
Refined, primary and secondary		476,252 r	499,116 r	509,970	495,952	518,357
Gold:						
Mine output, Au content	kilograms	24	310	166 r	233	266
Metal, refined	do.	28,595	26,181	40,262	32,449	42,485
Iron and steel:						
Iron ore and concentrate:						
Gross weight	thousand metric tons	195	365	289	328 r	305
Fe content	do.	109	164	125	138 r	131
Metal:						
Pig iron	do.	25,898	26,570	27,314	27,556	27,309
Ferroalloys:						
Ferromanganese		143,525	137,000	141,000	165,525	124,000
Ferrosilicomanganese		101,877	94,000	90,942	82,917	74,000
Other		4,452	--	--	--	--
Total		249,854	231,000	231,942	248,442	198,000
Steel, crude	thousand metric tons	43,852	45,390	46,310	47,521	47,770
Lead:						
Mine output, Pb content		988	28	--	40	57
Metal, smelter		162,075 r	179,863 r	169,297	173,609	180,784
Nickel		26,429	30,337	31,340	27,200	26,300
Silver:						
Mine output, Ag content	kilograms	1,316	6,811	11,704	5,059	3,515
Metal	do.	664,533	973,140	947,781	1,172,632	1,218,849
Zinc:						
Mine output, Zn content		5,130 r	99	--	14	80
Metal, primary		503,315	605,990 r	644,218	668,666	644,828
INDUSTRIAL MINERALS						
Barite		200	78	140	50	--
Cement, hydraulic	thousand metric tons	52,046	55,514	59,194	56,955 r	51,391
Clays, kaolin	do.	2,384 r	2,831 r	3,009	2,780	2,767
Diatomaceous earth		27,530	20,666	15,636	2,441	2,193
Feldspar		389,361 r	415,580 r	477,012	541,788	508,644
Graphite, all types		238	94	58	247	39
Lime, slaked lime		298,362	216,536	220,000 e	210,000 e	205,000 e
Mica, all grades		109,339	29,870	33,651 r	59,238	36,623
Nitrogen, N content of ammonia		385,200	152,600	118,900	163,400	165,000 e
Salt		800,000 e	800,000 e	800,000 e	340,828 r	378,887
Soda ash, manufactured[2]		310,000	310,000	310,000	310,000	310,000
Stone, sand and gravel:						
Limestone	thousand metric tons	81,949 r	86,008 r	90,626 r	85,549 r	79,168
Quartzite	do.	2,377	3,041	2,966	2,842	2,868
Sand, including glass sand	do.	900	891	480	554	461
Sulfur, byproduct:[3]						
Metallurgy	do.	665	737	797	796	800
Petroleum	do.	690	687	757	879	900
Total	do.	1,355	1,424	1,554	1,675	1,700

See footnotes at end of table.

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TABLE 1--Continued
REPUBLIC OF KOREA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2001	2002	2003	2004	2005
INDUSTRIAL MINERALS--Continued						
Talc and related materials:						
Pyrophyllite		1,101,825	889,961	912,285	827,895	885,559
Talc		47,712	37,863	47,911	79,313 r	83,471
Zeolite		145,162	149,335	132,760	142,401	173,435
MINERAL FUELS AND RELATED MATERIALS						
Carbon black		435,285 r	459,985	464,941	473,788	471,716
Coal, anthracite	thousand metric tons	3,817	3,318	3,297 r	3,191 r	2,832
Fuel briquets, anthracite briquets	do.	1,100 e	1,200 e	1,191	1,385	1,400 e
Petroleum, refinery products	thousand 42-gallon barrels	930,000 e	940,000 e	796,000	886,415 r	922,647

eEstimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. rRevised. -- Zero.
[1]Table includes data available through July 14, 2006.

Sources: Ministry of Commerce, Industry and Energy, Korea Institute of Geoscience and Mineral Resources, Current status of minerals supply and demand, 2005; U.S. Geological Survey Minerals Questionnaire 2000-05.

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TABLE 2
REPUBLIC OF KOREA: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Bismuth, metal	metric tons	Korea Zinc Co. Ltd.	Onsan	100
Cadmium	do.	do.	do.	2,000
Cement		Ssangyong Cement Industrial Co. Ltd.	Plants at Tonghae, Kwang Yang, Munkyung, Pukpyong, and Yeongwol	15,040
Do.		Sung Shin Cement Manufacturing Co. Ltd.	Tanyang plant	13,700
Do.		Tong Yang Major Corp.	Plants at Pukpyong and Samchok	11,580
Do.		Lafarge Halla Cement Corp.	Plants at Kwang Yang and Okkye	9,500
Do.		Hyundai Cement Co. Ltd.	Plants at Tanyang and Yongwol	8,600
Do.		Hanil Cement Manufacturing Co.	Plants at Chungbuk and Tanyang	7,200
Do.		Asia Cement Manufacturing Co. Ltd.	Plants at Daegu and Jaechon	4,600
Coal		Korea Coal Corp.	Mines at Changsung, Dogae, and Hwasoon	2,000
Copper, metal, primary		Korea Zinc Co. Ltd.	Onsan	20
Do.		LS-Nikko Copper Inc.	Changhang	60
Do.		do.	Onsan	510
Gas, natural		Korea National Oil Corp.	Ulleung Basin	NA
Gold:				
In concentrate	kilograms	Ivanhoe Mines Ltd.	Haenam, Cholla Province	1,600
Refined	do.	Korea Zinc Co. Ltd.	Onsan	50,000
Do.	do.	LS-Nikko Copper Inc.	do.	60,000
Graphite		Kaerion Graphite Ltd.	Kangwon	NA
Do.		Wolmyong Mining Co.	do.	NA
Indium, metal	do.	Korea Zinc Co. Ltd.	do.	55,000
Lead, metal, primary		do.	do.	200
Nickel, metal		Korea Nickel Corp.	do.	48
Petroleum, refinery products	thousand 42-gallon barrels per day	SK Corp.	Ulsan	817
Do.	do.	LG-Caltex Corp.	Yocheon (Yosu)	650
Do.	do.	Hyundai Oil Refinery Co.	Daesan and Inchon	589
Do.	do.	S-Oil Corp.	Onsan	520
Silver:				
In concentrate	kilograms	Ivanhoe Mines Ltd.	Haenam, Cholla Province	3,700
Refined	metric tons	Korea Zinc Co. Ltd.	Onsan	1,000
Do.	do.	LS-Nikko Copper Inc.	do.	370
Steel, crude		Pohang Iron and Steel Co. Ltd.	Kwangyang (Gwangyang) Works	15,000
Do.		do.	Pohang Works	13,000
Do.		Hyundai INI Steel Co.	Incheon Plant	4,800
Do.		do.	Pohang Plant	3,200
Do.		Dongkuk Steel Mill Co. Ltd.	Inchon Works	1,450
Do.		do.	Pohang Works	3,600
Do.		Korea Iron and Steel Co. Ltd.	Masan and Changwon Works	1,200
Talc		Dongyang Talc Mining Co.	Chungju Mine	NA
Zinc, metal, primary		Korea Zinc Co. Ltd.	Onsan	430
Do.		Young Poong Corp.	Sukpo	280

NA Not available.

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The Mineral Industry of Malaysia

By Pui-Kwan Tse

Malaysia is located next to Brunei, Indonesia, Singapore, and Thailand in Southeast Asia and is a member of the Association of Southeast Asian Nations (ASEAN). It has a total land area of about 328,600 square kilometers (km^2) and had a population of about 26.7 million in 2005. The high oil prices in the international markets had only a moderate effect on Malaysia's economy in 2005. The Malaysian economy expanded by 5.3%, which was about 2% lower than that of 2004. The growth was in part a response to increased domestic and external demand. Except for the construction sector, most sectors posted positive growth rates. The manufacturing sector was stronger because the export-oriented industries, such as electronics, regained strength in the second half of 2005. The mining sector grew only slightly (by 0.8%) because of the decline in crude oil production, which, in turn, was a result of the shutdown of several oil installation facilities for maintenance. The decline in crude oil production was balanced by an increase in natural gas output, which grew in response to increased demand for domestic power generation and to fulfill the requirements of overseas contracts. Owing to the completion of several large infrastructure projects, the construction sector contracted by 1.5% in 2005. The gross domestic product (GDP) grew to $127.7 billion and the GDP per capita was $4,781 in 2005. The consumer price index increased by 3.0% in 2005, which was higher than the 1.4% increase in 2004 (Malaysian Industrial Development Authority, 2006, p. 1-16).

Government Policies and Programs

Because of the economic slowdown of the past several years, the Government focused on providing infrastructure and a better investment environment. The Government reformed the banking system, improved the delivery of Government services, moved from supporting large projects to funding smaller ones, and put greater emphasis on diversifying sources of growth into such sectors as services and agriculture.

The Malaysian Government continued its policy of pursuing balanced growth and a stable political and social environment. The manufacturing and service sectors would remain the engines of growth. The service sector, which accounted for more than 50% of the economy, was expected to grow because of increased domestic consumption and foreign trade. Mining activities were likely to improve during the next several years because of the discovery of new oilfields and gasfields in the State of Sabah during the past several years that were expected to begin production soon. The Government's 15-year Third Industrial Master Plan was directed at making the manufacturing and service sectors more knowledge-intensive and productive and, as a result, more globally competitive. The major export products were automotive parts, chemicals, electronics, and machinery. The value of exports was projected to increase by 2.7 times by 2020 (Malaysia External Trade Development Corp., 2006).

Production

Malaysia produced bauxite, coal, feldspar, gold, ilmenite, iron ore, kaolin, mica, monazite, natural gas, oil, sand and gravel, struverite, tin, and zircon. The production of tin metal increased owing to higher tin prices on the Kuala Lumpur Tin Market and the international market. Because of depleting ore reserves and lower ore grades, Malaysia imported tin concentrates from other countries to meet its demand. Owing to the shortage and high prices of raw materials, output of iron and steel declined in 2005. Malaysia was the leading producer of palm-oil-based products. In August 2005, the Government issued a national biofuel policy to encourage the use of palm-oil-based biofuel as an alternative and environmentally friendly energy source. With the increasing interest in the palm-oil-based biofuel, the output of palm oil was expected to increase and, as a result, so was the demand for fertilizers (Malaysian Industrial Development Authority, 2006, p. 82).

Trade

In 2005, Malaysia's total trade increased by 9.9% to $254.7 billion. Exports increased by 11.0% to $140.5 billion, and imports increased by 8.5% to $114.2 billion. The ASEAN countries, which remained Malaysia's leading export market, accounted for 26.1% of the total exports, of which Singapore received 15.5%. The United States was the leading destination country and received 19.7% of Malaysian exports followed by Japan, 9.0%; China, 6.6%; and Hong Kong, 5.5%. Electrical and electronic products accounted for 49.6% of the total exports, chemical and metal products accounted for 10.3% of the total exports, and crude oil and liquefied natural gas (LNG) accounted for 12.9% of the total exports and 97% of the mining products. The total export value of crude oil and LNG was $18.0 billion. Malaysia imported goods from Japan, 14.5%; the United States, 12.9%; Singapore, 11.7%; China, 11.5%; and Taiwan 5.5%. Ferrous and nonferrous goods accounted for 8.5% of the total imports. Downstream electronic products, which remained Malaysia's leading import commodity, were imported mainly from Japan and China. During the past 2 years, total trade between Malaysia and China increased sharply, and China replaced Japan as the country with which Malaysia had its largest trade deficit in 2005 (Ministry of International Trade and Industry, 2006, p. 11-30).

Malaysia had negotiated free trade agreements bilaterally and with ASEAN to gain market access for Malaysia's products and services; the agreements included reduction or elimination of tariffs on goods and liberalization of regulations regarding the service sector and investment. In November 2004, ASEAN

[1] References that include a section mark (§) are found in the Internet References Cited section.

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and China signed a free trade agreement; implementation of the agreement began on January 1, 2006. In December 2005, Malaysia entered into an economic partnership agreement with Japan that would eliminate nearly 93% of tariffs on products in the first 7 years of implementation. Investments between the two countries would be expanded. Malaysia planned to complete free trade agreements with Australia, New Zealand, and Pakistan in 2006 (Ministry of International Trade and Industry, 2006, p. 36).

Commodity Review

Metal

Aluminum.—Malaysia's bauxite resources are located at Bukit Batu, Bukit Gebong, Lundu-Semantan, and Tanjung Seberang in the State of Sarawak and at Bukit Mengkabau and Labuk Valley in the State of Sabah. The two operating bauxite mines in Malaysia were located at Bungai Rengit in the State of Johor. Owing to depleted resources, bauxite production decreased sharply in recent years. Malaysia did not have an aluminum refinery and smelter; all bauxite output, therefore, was exported to countries in Southeast Asia, and Malaysia imported unwrought aluminum to meet its demand. During the past 2 years, investors from Bahrain, China, the United Arab Emirates, and the United States had submitted proposals to the Malaysian Government to build aluminum smelters in Malaysia.

In November, 2005, China Aluminum International Engineering Co. Ltd., which was a subsidiary of state-owned Aluminum Corporation of China, and Smelter Asia Sdn. Bhd. signed a cooperation agreement in Beijing, China, on a 500,000-metric-ton-per-year (t/yr) Sarawah Aluminum Smelter project in the State of Sarawak. The construction was divided into two phases. The first phase of construction was expected to begin in 2006 and to be completed by 2007. Installation of a 320-kiloampere prebaked cell line and construction of a 600,000-t/yr carbon anode plant were included in the first-phase plan. Total investment was estimated to be $1.5 billion. Power for the smelter would be supplied by the Bakun hydroelectric powerplant. The company planned to source alumina from Australia and the United States (China Nonferrous Metals News, 2005).

In May 2005, Cahya Mata Sarawak Bhd of Malaysia and China's Shandong Luneng Group and Sinohydro Corp. signed a memorandum of understanding to jointly build an aluminum smelter in Similajau, State of Sarawak. The two Chinese companies held a total of 50% of the shares. Total investment was estimated to be $3 billion. The Export-Import Bank of China agreed to provide a 10-year low-interest-rate loan to Shandong Luneng. The proposal for the construction of the aluminum smelter was submitted to the Malaysian Government in December 2005. The smelter was expected to begin producing aluminum ingot in 2007 (Alumina and Aluminum Monthly, 2006).

Gold.—During the past several years, Malaysia's gold production was about 4 t (table 1). Gold output was mainly from the Penjom Mine, which was owned by Avocet Mining Plc of the United Kingdom and operated by its wholly owned subsidiary Specific Resources Malaysia Sdn. Bhd.; the mine was located at Penjom in the State of Pahang. Several small-scale gold mines were located in the States of Kelantan, Pahang, and Terengganu. Very few companies appeared to be interested in exploration in Malaysia, although Avocet continued its gold exploration in the neighborhood of Penjom. The company completed 1,000 meters drilling at Panau, which is located northwest of Penjom. If significant mineralization were to be intersected in the area, Avocet would apply for tenements to the Central and State governments for its exploration activities (Avocet Mining Plc, 2005).

Iron and Steel.—Malaysia produced small amounts of low-grade iron ore from the States of Pahang, Perak, and Terengganu. Domestic iron ore output was consumed by domestic pipecoating plants and cement plants. The country imported high-grade iron ore from Bahrain, Brazil, Canada, and Chile for ironmaking. In 2005, the prices of iron ore and scrap had surged and caused an increase in production costs for downstream manufacturing industries. As a result, Malaysia's production of crude steel and steel products decreased slightly in 2005. In 2005, Malaysia had a total installed capacity of 16.2 Mt (11.6 Mt for long products and 4.6 Mt for hot-rolled and cold-rolled coils); of that amount, the overall utilization rate was 56.8% (Ministry of International Trade and Industry, 2006, p. 88).

Kinsteel Bhd. planned to build an integrated electric arc furnace plant at its Gebeng plant in the State of Pahang. The plant will have a designed output capacity of 400,000 t/yr of crude steel and 300,000 t/yr of wire rod. The total investment was estimated to be $26.5 million. The construction was scheduled to begin at the end of 2005. Currently (2005), Kinsteel had an output capacity of 500,000 t/yr of steel products that included angles, bars, channels, and flats. Kinsteel signed a strategic alliance with Maju Holdings Sdn Bhd to acquire 51% equity interest in Maju's subsidiary Perwaja Steel Sdn Bhd. Kinsteel would pay $26.5 million cash and 60 million of Kinsteel shares, with $30.5 million to be settled by deferred payments. Perwajia had an output capacity of 1.2 Mt/yr of direct-reduced iron (DRI) and 1.3 Mt/yr of billet. The alliance would enable Kinsteel to improve its sales network in local and overseas markets (Southeast Asia Iron and Steel Institute, 2005, Star Online, 2005§[1]).

The Lion Group was the leading iron and steel producer in Malaysia. The Group has several operating facilities—Amsteel Mills Sdn Bhd, Antara Steel Mills Sdn Bhd, Bright Steel Sdn Bhd, Lion Steelworks Sdn Bhd, and Megasteel Sdn Bhd. The Group had a total annual output capacity of 4.4 Mt of crude steel, 800,000 t of hot-briquetted iron (HBI), 2.0 Mt of hot-rolled coils, and 1.4 Mt of cold-rolled coils. The Group signed a supply agreement with Midrex Technologies Inc. of the United States to set up a DRI plant at the Megasteel site. The plant was designed to produce 1.6 Mt/yr of DRI or HBI and was scheduled to begin operation in 2006. The supply of DRI was expected to reduce the dependence on scrap as raw material for steelmaking and to enable the production of high-grade steel for downstream products. The Group signed a long-term iron ore pellets supply agreement with Samarco Mineracao S.A. of Brazil for its HBI and DRI operations. The Group also considered building an integrated iron and steel plant as part of its 5-year plan

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(Malaysian Iron and Steel Industry Federation, 2005, p. 42-44; Metal Bulletin, 2005).

Tin.—Owing to depleted resources and lower ore grades after more than 100 years of active mining operations, Malaysia's tin mine production decreased to less than 3,000 t during the past 2 years despite a higher tin price in 2004 and 2005. The demand for tin was rising because it is used as raw material in the manufacture of flame retardants, industrial paint pigments, and lead-free solders for the electronics industry. Owing to an increase in tin mine operating costs, Malaysian tin miners had difficulty operating profitably despite the higher demand for and price of tin. Also, under the current policy, if an owner of agricultural land converts the use of the property to tin mining, ownership of the land reverts to the State government after the mining operations have ceased. Landlords would not be willing to convert agricultural land to mining land. Malaysia also faced a shortage of labor with mining skills (Star Online, 2006a§).

Malaysia Smelting Corp. Bhd. (MSC) was Malaysia's sole integrated tin producer and became a subsidiary of The Straits Trading Co. Ltd. in 2005. MSC had acquired 100% equity in Rahman Hydraulic Tin Sdn Bhd, which operated the open pit alluvial tin mine in the State of Perak, in 2004. In 2005, MSC produced a total of 58,250 t of tin ingot from its two smelters, Butterworth in Malaysia (36,870 t) and PT Koba Tin in Indonesia (21,380 t). To secure tin resources, MSC expanded its investments in Indonesia through its subsidiary PT MSC Indonesia and increased its interest in Australia Oriental Minerals NL in Australia.

In 2005, Malaysia consumed about 4,100 t of tin. The solder and the tinplating sectors continued to be the major tin consumption sectors. Malaysia exported 32,947 t of tin metal to, in descending order of amount received, Singapore, the Republic of Korea, Japan, and Taiwan. Malaysia imported 17,708 t of tin concentrates in 2005. MSC refined crude tin from Indonesia (Malaysia Smelting Corp. Bhd., 2006, p. 90-91). China, which was the leading tin metal producing country in the world, increased its consumption of tin metal during the past several years and, as a result, decreased its exports of tin metal. Indonesia and Malaysia have increased their exports of tin, which could influence the price of tin on the international market in the future.

Industrial Minerals

Magnesium.—The State Government of Perak granted approval to Commerce Venture Manufacturing Sdn Bhd (a subsidiary of Ho Wah Genting Bhd) to build a magnesium plant in the Kamunting Raya III Industrial Estate in the district of Larut Matang, State of Perak. The company planned to use the Pidgeon process in which dolomite is used as the main raw material. A dolomite mine was located about 60 kilometers from the plant site. The construction was scheduled to begin in 2006, and the plant would be put into operation in 2008 with an initial output capacity of 15,000 t/yr. Commerce Venture planned to double the output capacity of the plant after 1 year of operation. The plant's magnesium output was mainly intended for export. The company also planned to expand its operation in alloy production (Magnesium Monthly Review, 2006).

Mineral Fuels

Coal.—Malaysia's coal resources are located in the States of Perak, Perlis, Sabah, Sarawak, and Selangor. Coal was produced from the areas of Bintulu, Merit-Pila, Silantek, and Tutoh in the State of Sarawak. The country has coal reserves of 1.7 billion metric tons (Gt), of which about 1.4 Gt is located in Sarawak. Mining and exploration for coal was conducted only in Sarawak. Merit-Pila was the largest coalfield in Malaysia. Owing to increased mine output, Malaysia's coal production increased by about two-fold in 2005 compared with that of 2004. Because of increased domestic demand, coal imports increased to 9.3 Mt in 2005 from 8.6 Mt in 2004. The power-generating plants consumed about 70% of the total supply of coal (domestic production and imported) and the remaining was consumed by the cement and iron and steel sectors. Tenaga National Berhad planned to change its natural gas powerplants into coal-fired powerplants within the next several years, and the use of gas in its powerplants was expected to decrease to 49% from 72% in 2010. Major coal-fired powerplants under construction included Tanjung Bin and Jimah; Prai Power and the second phase of Port Dickson Power were under development. Coal demand was expected to increase to 19 Mt and, because domestic coal could not meet the demand, the country was expected to increase coal imports to fill the gap. Most imported coal was from Australia, China, and Indonesia (Malaysian Chamber of Mines, 2006).

Natural Gas and Petroleum.—Malaysia remained a net exporter of natural gas and crude oil. The average production of natural gas increased to 164 million cubic meters per day in 2005 from 147 million cubic meters per day in 2004. Production of crude oil and condensate decreased to an average of 727,000 barrels per day (bbl/d) in 2005 from 762,000 bbl/d in 2004. The lower production of crude oil was caused by the shutdown of several oil installation facilities during the year for repair and maintenance. The output of condensate accounted for about 20% of the total output. Owing to increasing demand from the domestic power generation and manufacturing sector, natural gas production continued to increase in 2005. The country exported about 50% of its natural gas in the form of LNG and crude oil and condensate production (Bank Negara Malaysia, 2006§).

Sabah Shell Petrolum Co. Ltd. (a unit of Royal Dutch/Shell Group) discovered a potential large oilfield from its Pisagan-1A exploration well, which was located off the coast of the State of Sabah. The discovery well was drilled in a water depth of 1,465 meters (m). Pisagan was located in Block G, in which Shell Malaysia Ltd. and ConocoPhillips Corp. of the United States each held 35% interest, and Malaysia's state-owned Petroliam Nasional Berhad (Petronas) held the remaining 30%. This was the first discovery following that of the Ubah-2 field (Rigzone.com, 2006b§).

CS Mutiara Petroleum Sdn Bhd, which was a joint-venture company of Petronas Carigali Sdn Bhd and Shell Exporation and Production Malaysia BV, announced the discovery of natural gas in Block PM302 in the northeast coast of Peninsular Malaysia. Gas from the Bunga Dahlia Channel-1 exploration well was found under a water depth of 2,260 m. The company had discovered six gas deposits in the area during the past

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2 years. CS Mutiara operated Blocks PM301 and PM302, which were located off the northeast coast of Peninsular Malaysia (Rigzone.com, 2006a§).

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TABLE 1
MALAYSIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2001	2002	2003	2004	2005
METALS						
Aluminum, bauxite, gross weight		64,161	39,975	5,732	2,040	4,735
Columbium (niobium)-tantalum metals, struverite, gross weight		8,430	2,298	2,619	121	552
Gold, mine output, Au content[3]	kilograms	3,965	4,289	4,739	4,221	4,250
Iron and steel:						
Iron ore, gross weight		376,476	404,350	596,612	663,732	949,605
Pig iron, direct-reduction iron and hot-briquetted iron	thousand metric tons	1,024 r	1,061 r	1,600	1,710 r	1,349
Steel, crude	do.	4,100	4,722	3,960	5,698 r	5,296
Lead metal, secondary[e]		38,000	40,000	40,000	40,000	40,000
Rare-earth metals, monazite, gross weight		643	441	795	1,683	320
Silver, mine output, Ag content[3]	kilograms	3	--	--	364	401
Tin:						
Mine output, Sn content		4,972	4,215	3,359	2,745	2,857
Metal, smelter		30,417	30,887	18,250	33,914	36,924
Titanium:						
Ilmenite concentrate, gross weight		129,750	106,046	95,148	61,471	38,196
Dioxide[e]		50,000	56,000	56,000	56,000	56,000
Zirconium, zircon concentrate, gross weight		3,768	5,292	3,456	6,886	4,954
INDUSTRIAL MINERALS						
Barite		649	3,082	--	--	--
Cement, hydraulic	thousand metric tons	13,820	14,336	17,243	15,692 r	17,860
Clays and earth materials	do.	29,596	23,092	23,909	24,221	28,757
Clays, kaolin		364,458	323,916	425,942	326,928	494,511
Feldspar		40,509	30,819	42,662	79,220	83,580
Mica		4,107	3,669	3,609	3,544	4,542
Nitrogen, N content of ammonia		726,000	847,900	909,500	842,500	850,000 e
Sand and gravel	thousand metric tons	15,020	19,574	17,955	18,371	17,072
Silica sand, peninsular Malaysia and Sarawak		575,105	447,398	533,617	631,402	531,891
Stone:						
Aggregate	thousand metric tons	66,996	84,934	85,142	51,236	52,317
Dolomite		2,850	--	--	27,500 r	38,500
Limestone	thousand metric tons	32,503	27,450	33,397 r	31,598 r	30,868
MINERAL FUELS AND RELATED MATERIALS						
Coal		497,733	352,513	172,820	389,176	789,356
Gas, natural:[4]						
Gross	thousand metric tons	58,751	60,791	65,173	67,530	74,351
Net[5]	do.	46,707	48,329	51,813	53,688	59,111
Liquefied natural gas	do.	15,423	15,007	17,311	20,729	21,948
Petroleum:[4]						
Crude and condensate	thousand 42-gallon barrels	243,696	254,770	269,370	279,009	267,720
Refinery products[e, 6]	do.	142,000	144,000	142,000	144,000	141,000

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. -- Zero.

[1]Table includes data available through September 29, 2006.

[2]In addition to the commodities listed, a variety of crude construction materials, which include clays and stone, fertilizers, and salt, is produced but not reported, and information is inadequate to make reliable estimates of output levels.

[3]Includes byproduct from tin mines in peninsular Malaysia and gold mines in peninsular Malaysia and the State of Sarawak.

[4]Includes production from peninsular Malaysia and the States of Sabah and Sarawak.

[5]Gross less volume of reinjected and flared.

[6]Includes liquefied petroleum gas, naphthas, and lubricants.

Sources: Ministry of Primary Industry, Minerals and Geoscience Department (Kuala Lumpur), Malaysian Minerals Yearbook 2005, Monthly Statistics on the Mining Industry in Malaysia; Department of Statistics (Kuala Lumpur), Monthly Statistical Bulletin, April 2005; U.S. Geological Survey Minerals Questionnaire, 2005; and Southeast Asia Iron and Steel Institute, Steel Statistical Yearbook, 2005.

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TABLE 2
MALAYSIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Bauxite		Johore Mining and Stevedoring Co. Sdn. Bhd. (ALCAN Ltd. of Canada, 61%, and local investors and others, 39%)	Teluk Rumania and Sg. Rengit, Johor	400.
Cement[1]		Cement Industries of Malaysia Bhd. (United Engineers Malaysia Bhd., 53.97%, and others, 46.03%)	Kangar, Perlis	2,000 cement; 1,600 clinker.
Do.		Lafarge Malayan Cement Bhd. (majority owned subsidiary of Lafarge S.A.)	Rawang, Selangor; Kanthan, Perak, Langkawi, Kedah; and Pasir Gudang, Johor	12,800 cement; 7,900 clinker.
Do.		Negeri Sembilan Cement Industries Sdn. Bhd. (wholly owned subsidiary of Cement Industries of Malaysia Berhad)	Bahau, Negeri Sembilan	1,400 cement; 1,200 clinker.
Do.		Pahang Cement Sdn Bhd. (50-50 joint venture of Pahang State government and YTL Cement Berhad)	Bukit Sagu, Pahang	1,300 cement; 1,200 clinker.
Do.		Perak-Hanjoong Simen Sdn. Bhd. (Gopeng Bhd., 45%, and Korea Heavy Industries and Construction Co. and others, 55%)	Padang Rengas, Perak	3,400 cement; 3,000 clinker.
Do.		Tasek Corp. (publicly owned company)	Ipoh, Perak	2,300 cement; 2,300 clinker.
Gas:				
Natural	million cubic meters per day	ExxonMobil Exploration and Production Malaysia, Inc.	Offshore Terengganu	45.
Do.	do.	Sabah Shell Petroleum Co. Ltd.	Offshore Sabah	3.
Do.	do.	Sarawak Shell Bhd.	Offshore Sarawak	80.
Liquefied		Malaysia LNG Sdn. Bhd. (Petroliam Nasional Berhad, 65%; Shell Gas N.V., 15%; Mitsubishi Corp., 15%; Sarawak State government, 5%)	Tanjung Kidurong, Bintulu, Sarawak	8,100.
Do.		Malaysia LNG Dua Sdn. Bhd. (Petroliam Nasional Berhad, 60%; Shell Gas N.V., 15%; Mitsubishi Corp., 15%; Sarawak State government, 10%)	do.	7,800.
Do.		Malaysia LNG Tiga Sdn. Bhd. (Petroliam Nasional Berhad, 60%; Shell Gas N.V., 15%; Nippon Oil LNG (Netherlands) BV, 10%; Sarawak State government, 10%; Diamond Gas Netherlands BV, 5%)	do.	6,800.
Gold, refined	kilograms	Specific Resources Malaysia Sdn. Bhd. (joint venture of Pahang State Development Corp. and Avocet Mining plc of the United Kingdom)	Penjom, Pahang	4,000.
Iron and steel:				
Hot-briquetted iron		Amsteel Mills Sdn. Bhd. (Lion Group)	Labuan Island, offshore Sabah	800.
Direct-reduced iron		Perwaja Steel Sdn. Bhd. (Lion Group, 51%, and Maju Holdings Sdn. Bhd., 49%)	Kemaman, Terengganu	1,200.
Crude steel		Amsteel Mills Sdn. Bhd. (Lion Group)	Klang and Banting, Selangor	1,300.
Do.		Antara Steel Sdn Bhd (Lion Grop)	Pasir Gudang, Johr	600.
Do.		Kinsteel Sdn Bhd (Lion Group)	Kuantan, Pahang	500.
Do.		Megasteel Sdn Bhd (Lion Group)	Banting, Selangor	2,500.
Do.		Perwaja Steel Sdn. Bhd. (Lion Group 51%, and Maju Holdings Sdn. Bhd., 49%)	Kemaman, Terengganu	900.
Do.		Southern Steel Bhd. (Camerlin [a member of Hong Leong Group Malaysia], 40.75%; Natsteel Ltd., 27.03; others, 32.22%)	Prai, Penang	1,200.
Nitrogen, ammonia		Asean Bintulu Fertilizer Sdn. Bhd. (Petroliam Nasional Berhad, 63.5%; P.T. Pupuk Sriwidjaja Indonesia, 13%; Thai Ministry of Finance, 13%; Philippines National Development Co., 9.5%; Singapore Temasek Holdings Pte. Ltd., 1%)	Bintulu, Sarawak	395.
Do.		PETRONAS Fertilizer Kedah Sdn. Bhd. (wholly owned subsidiary of Petroliam Nasional Berhad)	Gurun, Kedah	378.
Do.		PETRONAS Ammonia Sdn Bhd. (wholly owned subsidiary of Petroliam Nasional Berhad)	Kerth, Terengganu	370.
Petroleum, crude	thousand 42-gallon barrels per day	ExxonMobil Exploration and Production Malaysia, Inc.	Offshore Terengganu	390.
Do.	do.	Sabah Shell Petroleum Co. Ltd.	Offshore Sabah	100.
Do.	do.	Sarawak Shell Bhd.	Offshore Sarawak	184.

See footnote at end of table.

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TABLE 2--Continued
MALAYSIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Petroleum, crude--Continued:	thousand 42-gallon barrels per day	PETRONAS Carigali Sdn. Bhd.	Offshore Terengganu	22.
Do.	do.	Murphy Sarawak Oil Co. Ltd.	Offshore Sarawak	15.
Tin:				
Concentrate		Delima Industries Sdn. Bhd.	Dengkil, Selangor	1.1.
Do.		Maiju Sama Sdn. Bhd.	Puchong, Selangor	1.6.
Do.		New Lahat Mines Sdn. Bhd.	Lahat, Perak	0.3.
Do.		Omsam Telecommunication Sdn. Bhd.	Bakap and Batu Gajah, Perak	0.5.
Do.		Rahman Hydraulic Tin Bhd.	Klian Intan, Perak	1.2.
Do.		S.E.K. (M) Sdn. Bhd.	Kampar, Perak	0.4.
Do.		Tasek Abadi Sdn Bhd.	Senudong and Kampar, Perak	0.5.
Refined		Malaysia Smelting Corp. Bhd. (The Straits Trading Co. Ltd., 37.44%; Malaysia Mining Corp., 37.44%; others, 25.12%)	Butterworth, Penang	35.
Titanium dioxide		Huntsman Tioxide Sdn. Bhd. (a subsidiary of Huntsman Trioxide of the United Kingdom)	Kemaman, Terengganu	56.

[1]All companies operated integrated plants.

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THE MINERAL INDUSTRY OF MONGOLIA

By Pui-Kwan Tse

Mongolia is a landlocked country that is bordered by China to the south and Russia to the north. It has one of the lowest population densities in the world; the population is about 2.56 million, and the total land area is about 1.56 million square kilometers. In 2005, the country's economic growth rate was 6.2% compared with 10.1% in 2004. The gross domestic product (GDP) increased to $18.5 billion, and inflation in terms of the consumer price index increased by 12.7% in 2005. The double-digit increase in the inflation rate was caused by higher food and fuel prices. Expansion of the mining and service sectors was the main contributor to economic growth. The increased contribution to the economy was owing to higher copper and gold prices of the mining sector and to the increase in gold production. The value of industrial production declined because of cutbacks in the textile sector that followed full implementation of the agreement on textile and clothing on December 31, 2004. The textile sector was built through foreign investment, mostly from China, because Mongolia did not have an export quota for textiles shipped to the United States. In 2005, most China-based producers closed their production lines in Mongolia (National Statistical Office of Mongolia, 2005, p. 21).

Mongolia has rich mineral deposits of coal, copper, fluorspar, and gold. Since the economic reform of the 1990s, the Mongolian Government has gradually privatized the mining sector. The mining and quarrying sector accounted for 52% of the total industrial output value and 18% of the GDP. In the past, mineral exploration was hampered by limited infrastructure and significant climate change in Mongolia. During the past several years, economic and governmental reforms have led to increased foreign investment in mineral exploration and exploitation in the country. The mining sector accounted for 47% of total foreign direct investment in 2005 (Mineral Resources and Petroleum Authority of Mongolia, 2006).

The current mineral law was adopted in 1997 and amended in 2001. The amended mineral bill recommended an increase in the minerals royalty to 5% from 2.5%, an increase of the license fee, and an added export customs tax on mining products. The bill also proposed reducing tax incentives for mining. Under the current mineral law, companies receive 100% tax exemption for the first 5 years of operation followed by 50% for the next 5 years. The proposed bill would reduce the 100% tax exemption to the first 2 years followed by a 50% exemption for the next 3 years. The duration of exploration licenses would be changed to 2 years with a discretionary extension of 3 years and the option of a 2-year extension. The proposed changes could provide more opportunity to local companies without affecting foreign investment. The draft bill also proposed changing the term of mineral resource licenses to 20 years with the possibility of two 10-year extensions for a total of 40 years instead of the current terms of 60 years with a possible extension of 40 years for a total of 100 years. The drafted amendments to the mineral law would enhance the accountability of mining companies with respect to production activities and rehabilitation of the environment and could improve the relationship between the local government and mining entities. The proposed amendments included up to 30% Government ownership of "strategically significant" resources, which were defined to include coal, copper, gold, lead, silver, uranium, and zinc, and mineral deposits owned by foreign investors. The proposed amendments on the mineral law were submitted to the Parliament for approval in December and were expected to be enacted in 2006 (Mining Journal, 2005; UB Post, 2005§[1]).

In 2005, the Government also submitted to the Parliament a "windfall profit tax on some products" bill, which would establish export customs tariffs on some types of minerals being extracted and processed. Major export-related minerals, which included coal, copper, fluorspar, gold, and molybdenum, were expected to be affected. An additional tax on profits would be imposed on copper and gold if the price of copper and gold exceed $2,600 per metric ton and $500 per troy ounce, respectively, on the London Metal Exchange. The new law was expected to be passed by the Parliament in spring 2006. The proposed new laws may affect foreign investor confidence in the future of Mongolia's mineral sector (Mining Journal, 2006b).

Since the 1990s, the Asian Development Bank and the World Bank have provided loans and assistance to the Mongolian Government to promote the development of a sound financial sector to support private-sector-led growth. The Ministry of Finance submitted a package of revised taxation laws to the Parliament for approval in 2005. The amendments will change personal and corporate income taxes and value-added taxes (VAT). The revised law is intended to eliminate double taxation and reduce taxes. The personal income tax rate will be set to a single rate of 10% to replace the existing three-tiered rate. The corporate income tax rate will be changed to a single rate of 25% of total income instead of the current rates of 30% and 15% depending on earned income. The VAT will be reduced to 10% from 15% in the proposed package. The proposed changes are based on the recommendation by the International Monetary Fund and the need to improve the country's competitiveness globally (U.S. Agency for International Development, 2006).

The country's trade has been heavily influenced by economic developments in China and Russia. In 2005, Mongolia's total trade increased by 19.0% to $2.25 billion. Because of high global metal market prices, the value of exports increased by 22.4% to $1.07 billion. Owing to an increased demand for agricultural products and mineral fuels, the value of imports increased by 16.0% to $1.18 billion. The value of metal and mineral exports and imports accounted for about 70.2% of the country's total export value. Mongolia exported nearly all its output of concentrates of copper, molybdenum, and zinc to China and shipped fluorspar to Russia, Ukraine, and the

[1]References that include a section mark (§) are found in the Internet References Cited section.

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United States. Gold was exported mainly to, in descending order of amount exported, Canada, the United Kingdom, the United States, and the Republic of Korea. Petroleum and petroleum products remained the leading imported commodities followed by textiles and flour. Mineral exports from Mongolia were expected to increase in the next few years because of the increased output of copper, gold, and zinc when new mines are put into operation. China and Russia were Mongolia's two major trading partners. China accounted for 48.3% of Mongolia's total export value, and the United States, 14.3%. Russia was the leading source of Mongolia's imports; it accounted for 35.3% of the total imported value followed by China, with 25.9% (National Statistical Office of Mongolia, 2005, p. 48-56).

The leading mining operation in Mongolia, Erdenet Mining Corp., increased its mining output to more than 27 million metric tons per year (Mt/yr) of ore from 25 Mt/yr and produced concentrates that contained more than 130,000 metric tons (t) of copper and 1,500 t of molybdenum. Because of a decline in the average ore grade, the output of copper in concentrates decreased to 126,547 t, but the output of molybdenum in concentrates increased slightly to 1,188 t because of higher metal content in the ore. Outokumpu Group of Finland signed a memorandum of understanding (MOU) with Erdenet to build a 35,000-metric-ton-per-year (t/yr) copper rod plant; Outokumpu's HydroCopper process would be used for low-grade copper concentrates. When the Erdenet ore was tested at a pilot plant, the test results indicated that the process produced 1 metric ton per day of pure copper powder and that the copper content in the powder was higher than London Metal Exchange's grade A purity. The powder was used to produce copper wire rod by Outokumpu Upcast (Erdenet Mining Corp, 2006§).

The permit for the Oyu Tolgoi (Turquoise Hill) deposit at Oyu Tolgoi, Umnogovi Aimag (South Gobi Province) in the southern Gobi region was originally held by BHP Inc. in 1996; Ivanhoe Mines Ltd. acquired it in the late 1990s. Four major ore bodies have been identified at Oyu Tolgoi. GRD Minproc Ltd. estimated that the proven and probable reserves at the Southern Oyu pits of Oyu Tolgoi were 930 million metric tons (Mt) at average grades of 0.50% copper and 0.36 gram per metric ton (g/t) gold (Ivanhoe Mines Ltd., 2006). Ivanhoe completed the feasibility study for the development of the Southern Oyu gold-rich open pits. During the first stage, the initial throughput rate of the mine would be 70,000 t/d during the first 5 years and would increase to 85,000 t/d in the sixth year. The average annual production was projected to be 450,000 t of copper and 10.2 t of gold for 35 years. Initial capital investment was estimated to be $1.15 billion. The mine was expected to begin production in 2008 (Ivanhoe Mines Ltd., 2005).

Ivanhoe and the Mongolian Government were discussing a formal investment contract for the Oyu Tolgoi project that included tax restructuring and infrastructure development. The proposed amendments in the mineral resources law and tax laws would be the basis of final negotiations. The mineral law amendments would give the Government the option to acquire interests in mineral deposits that were considered to be "strategic" because they could have an impact on Mongolia's national security and economic and social development. The Government could acquire up to 34% interest in projects that were discovered and/or explored with the use of private funds and 50% interest in projects that were discovered with the use state funds (Open Society Forum, 2006§).

Gold mining in Mongolia increased significantly during the past decade, and the number of companies engaged in gold mining grew in the 1990s to more than 100 and produced a total of more than 12 t of gold. Because most of the companies were placer gold producers and many placer deposits were nearly depleted, gold output decreased in the early 2000s. In 2004, a number of gold mines were under development. Gold mines at Borro, Bumbat, and Olon Ovoot were put into operation. Gold output increased sharply and was expected to continue to increase in the near future. Domestic gold demand was mainly for jewelry. Boroo Gold Co., in which Centerra Gold Inc. of Canada had a 95% equity interest, was the leading gold producer and accounted for nearly 40% of Mongolia's total gold output. Centerra completed its feasibility study of the Gatsuurt gold deposit, which is located 35 kilometers from the Boroo Mine. The probable reserves of the Gatsuurt deposit at the central and main zones was 30.7 t of gold. The company planned to haul oxide ore from Gatsuurt to the Boroo processing facility. A biooxidation treatment plant to process refractory ore would be constructed at the Boroo facility in 2008. Centerra continued its exploration work in 2006 (Mining Journal, 2006a).

In 2002, QGX Ltd. of Canada discovered a massive sulfide deposit, Golden Hills, in Western Mongolia. The deposit covered an area of 7,500 square kilometers (km^2) and contained measured and indicated resources of 175,000 t of copper, 113 t of silver, and 12.7 t of gold. Metals are contained in oxide, sulfide, and quartz-telluride veins in three distinct zones—central, north, and south. QGX can earn an 80% interest in the Golden Hills prospect by investing $450,000 in the property by 2005 and can increase its interest to 100% by spending $1 million. Batch tests on extraction of gold and silver from oxide ore showed promising results in 2005. Work will continue in 2006 (QGX Ltd., 2006).

Tumurtei Iron Ore Co. Ltd. signed an agreement with Baotou Iron and Steel Group Co. Ltd. of Nei Mongol Autonomous Region, China, to supply 60% of its iron output to Mining Material Co. Ltd. (a subsidiary of Baotou). Tumurtei was a joint-venture of three Chinese companies—Helongjiang International Economic and Technical Cooperative Corp., Qinglong International Industrial Co. Ltd., and Shougang Mining Investment Co. Ltd.—and a Mongolian company. Tumurtei's iron ore mine has proven reserves of 230 Mt at a grade of from 51% to 54% iron. Construction of the mine started in 2004 and the mine was scheduled to be put into operation in 2006; the designed output capacity was 4 Mt/yr (China Metals, 2005).

The construction of Tsairt Minerals' Tumurtiin Ovoo Mine near the town of Sukhe Bator, Sukbataar Province, began in October 2003 and was completed in August 2005. The mine was jointly owned by China Nonferrous Metal Industry Engineering Co. Ltd. (51%) and Mentalimpex of Mongolia (49%). The mine had 7.5 Mt of ore reserves with an average grade of 13.67% zinc. The open pit mine was designed to mine 300,000 t of ore and could produce 66,000 t/yr of zinc in concentrates for 25 years. The construction cost was $43 million (China Nonferrous Metals News, 2006).

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Asia Gold Corp. of Canada and Ivanhoe reached an agreement for Asia Gold to acquire Ivanhoe's coal division in exchange for common shares of Asia Gold. As a result of this agreement, Asia Gold became a subsidiary of Ivanhoe. The agreement required approval from the Toronto Stock Exchange Venture Exchange and fulfillment of other regulatory requirements. Ivanhoe owned the Nariin Sukhait coal deposit, which has measured and indicated coal resources of 124 Mt. Asia Gold focused on exploring for coal, copper, and gold in Mongolia. In 2005, Asia Gold discovered the Khongor porphyry copper-gold prospect and the Naran Bulag gold prospect at Asia Gold's Western property in the Gobi region. The Western Gobi property has an area of 24,748 km^2 and its eastern boundary is located about 150 kilometers (km) west of Ivanhoe's Oyu Tolgoi deposit. Asia Gold will continue exploring on the property in 2006. Asia Gold also explored its West Falcon Gobi property, which covers an area of 12,662 km^2. BHP Billiton also explored coal in the West Falcon Gobi property (Asia Gold Corp., 2006).

Mongolia has a potential 100 billion metric tons of coal resources. During the past decade, annual coal production was about 5 Mt/yr. During the past 2 years, coal output increased sharply because the Government privatized several state-owned mines in the Gobi region and expanded their output to meet the increasing demand for coal in China. The Tavan Tolgoi deposit in the South Gobi was the largest discovered coal deposit in Mongolia and contained more than 5 billion metric tons of coking and steam coal. BHP Billiton expressed interest in developing the Tavan Tolgoi deposit. Other potential coal deposits for development included Tevshiin Govi, Tsaidam, and Tugrong Nuur (Mineral Resources and Petroleum Authority of Mongolia, 2006).

Geologists had discovered that the geologic formations of the East Gobi and the Tamsag Basins in eastern Mongolia have many similarities with the Erlian and the Khailaar Basins in China. Estimations of oil resources in Mongolia ranged between 4 billion and 6 billion barrels (Gbbl). Recent studies showed that the Tamsag Basin had oil reserves of between 50 million barrels (Mbbl) and 1.5 Gbbl. SOCO International plc of the United Kingdom explored contract block areas XIX, XXI, and XXII in the Tamsag Basin. Dongsheng Petroleum of China and Roc Oil Co. of Australia jointly explored contract block areas XIII and XIV in the eastern Gobi Basin under a production-sharing contract. SOCO drilled four wells in area XIX. During the pilot production runs, wells 19-21 and 19-20 flowed at rates of 120 barrels per day (bbl/d) and 70 bbl/d, respectively. Mongolian-based Petro Matad signed an agreement with the Mongolian Government to explore for oil in the Matad-20 field in Dornod Province and planned to invest more than $10 million in the next 5 years in exploration (Mongolia Development Gateway, 2006§).

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Major Publications

National Statistical Office of Mongolia, Ulaanbaatar, Mongolia:
Statistical Bulletin, monthly.
Mongolian Statistical Yearbook, annual.

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TABLE 1
MONGOLIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2001	2002	2003	2004	2005
Cement, hydraulic	thousand metric tons	68	148	162	62 r	112
Coal	do.	5,141	5,307	5,666	6,794 r	8,256
Copper:						
Mine output, Cu content		133,503	131,705	130,270	130,000	126,547
Metal, refined		1,476	1,500	1,341	2,376	2,475
Fluorspar:						
Acid grade	thousand metric tons	127	86	120	148 r	134
Submetallurgical and other grade	do.	72	99	150	206 r	233
Total	do.	199	185	270	354 r	367
Gold, mine output, Au content[3]	kilograms	13,675	12,097	11,119	19,240 r	24,120
Gypsum[e]	thousand metric tons	25	25	25	25	25
Iron ore:						
Gross weight	do.	--	--	--	33	168
Iron content	do.	--	--	--	21	109
Lime, hydrated and quicklime	do.	30	42	42	30 r	81
Molybdenum, mine output, Mo content		1,514	1,590	1,793	1,141	1,188
Petroleum, crude	thousand 42-gallon barrels	74	139	183	216 r	201
Salt, mine output		1,800	1,268	1,971	1,550 r	1,896
Silver, mine output, Ag content[e, 4]	kilograms	27,200	27,000	27,000	28,000	28,000
Steel, crude		10,000	15,900	39,300	54,900 r	65,500
Tungsten, mine output, W content		63	35	40	77 r	78

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. -- Zero.

[1]Table includes data available through September 20, 2006.

[2]In addition to the commodities listed, crude construction materials, such as sand and gravel, and varieties of stones, such as limestone and silica, are produced, but available information is inadequate to make reliable estimates of output levels.

[3]Reported raw gold production but excludes gold contained in copper concentrate.

[4]Based on 55 grams per ton silver in copper concentrate.

Sources: National Statistical Office of Mongolia (Ulaanbaatar); Mongolian Statistical Yearbook 2001-2004; Mineral Resources Authority of Mongolia, Mining Office, Output of Mineral Commodities (Minerals Questionnaire 2001-2005).

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The Mineral Industry of New Caledonia

By Travis Q. Lyday and Staff

The Territory of New Caledonia and Dependencies is located in Oceania in the South Pacific Ocean east of Australia and close to Vanuatu, which lies to the northeast. Although both Britain and France originally settled New Caledonia during the first half of the 19th century, the islands became a French possession in 1853 during the reign of Napoleon III. New Caledonia consists of La Grand Terre, which is the territory's main island and one of the largest islands in the Pacific Ocean; the archipelago of Loyaute; and numerous small, sparsely populated islands and atolls. The capital of the territory is Noumea, which is located on La Grand Terre. The territory has only three administrative divisions (provinces), which are Iles Loyaute, Nord, and Sud (Loyalty Islands, North, and South, respectively).

New Caledonia's total area is 19,060 square kilometers (km^2), which is slightly smaller than the U.S. state of New Jersey. New Caledonia's land area covers 18,575 km^2, and its water areas, 485 km^2. The territory has 2,254 kilometers of coastline (U. S. Central Intelligence Agency, 2006§[1]). New Caledonia's population in 2005 was estimated to be 216,494. The largest ethnic group was of Melanesian origin, about 42.5%, followed by European, 37.1%, Wallisian, 8.4%, Polynesian, 3.8%, Indonesian, 3.6 %, and Vietnamese, 1.6% (Resource Information Unit, 2006, p. 44).

New Caledonia is rich in mineral resources. The country's mineral resources were chromium, cobalt, copper, gold, iron, manganese, nickel, and silver. However, in the past 5 years, nickel was the only mineral produced in large quantity, mainly by Société le Nickel (SLN) in the form of crude ore, ferronickel, and nickel matte. All nickel products were exported mainly to Australia, France, and Japan.

The mineral industry of New Caledonia continued to be dominated by the mining of nickeliferous laterite-saprolite and garnierite ores and the production of ferronickel of various commercial grades and nickel matte at the 75,000-metric-ton-per-year (t/yr)-capacity Doniambo Smelter near Noumea. The products of the Doniambo plant consisted of about 80% ferronickel and 20% matte. The ferronickel was used primarily in making stainless steel, and the nickel matte was shipped to Eramet S.A.'s Sandouville Refinery near La Havre in northern France for conversion into high-purity nickel metal and salts of nickel and cobalt. The Doniambo Smelter was owned and operated by SLN. SLN was privatized by the French Government in 1999. SLN's shareholders became Eramet, 60%, Nisshin Steel Co. of Japan, 10%, and representatives from the three New Caledonian Provinces through a public company, Société Territoriale Caledonienne de Participation Industrielle, 30% (Resource Information Unit, 2006, p. 134).

New Caledonia was the world's fifth ranked nickel producer following Russia, Australia, Canada, and Indonesia (Kuck, 2007). The French Overseas Territory has about 25% of the world's known nickel resources (Resource Information Unit, 2006, p. 45).

SLN mined nickel ore on the main island (La Grande Terre) from six operations: the Kouaoua, the Koumac, the Nepoui, the Poro, the Thio, and the Tiebaghi Mining Centers. Their output supplied feed to SLN's Doniambo Smelter. Nickel mines at the Boa Kaine, the Ouaco, the Poum, and the Poya Mining Centers were owned and operated by Société Minière du Sud Pacifique (SMSP). SMSP mined nickel ore and exported it to Australia to be used as feed for BHP Billiton Ltd.'s Yabulu refinery in Townsville, Australia, and to Japan (Resource Information Unit, 2006, p. 45).

Outlook

Substantial recent investments in the nickel industry, combined with the recovery of global nickel prices are expected to brighten New Caledonia's economic outlook during the next 5 years. Inco Ltd. of Canada planned to undertake a $2.2 billion Goro Nickel-Cobalt Project near the southeastern tip of New Caledonia. Social and environmental concerns about the project continued to prompt protests by indigenous Kanak groups, however, and could delay or even shelve the project. As a result, the economic outlook may not be as bright as expected beyond 2008.

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[1]A reference that includes a section mark (§) is found in the Internet Reference Cited section.

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TABLE 1

NEW CALEDONIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2001	2002	2003	2004	2005
Cement		92,868	100,080	100,171	114,762	119,302
Nickel:						
Ore:						
Gross weight	thousand metric tons	7,220	5,944	6,625	7,033 r	6,445
Co content[3]		3,540	2,780	2,602	2,721	2,590 e
Ni content		117,734	99,841	112,013	118,279	111,039
Ferronickel:						
Gross weight		153,012	162,973 r	167,208 r	143,400 e	155,800 e
Ni content		45,912	48,650	50,666	43,016	46,738
Nickel matte:						
Gross weight		17,586	15,583	15,309	17,200	18,100
Ni content		13,061	11,217	10,857	12,164	12,838

eEstimated; estimated data are rounded to no more than three significant digits. rRevised.

[1]Table includes data available through October 2006.

[2]In addition to the commodities listed, crude (unspecified) and crushed stone, construction sand, and silica sand for metallurgical use are produced, but available information is inadequate to make reliable estimates of output.

[3]Includes only cobalt contained in mined limonite.

Source: Institut de la Statistique et des Études Économique, New Caledonia and U.S. Geological Survey, Minerals Questionnaire, 2001-05.
British Geological Survey, World Mineral Production 2000-04.

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THE MINERAL INDUSTRY OF NEW ZEALAND

By Staff

New Zealand's economic minerals included metallic and industrial minerals and mineral fuels. Output of gold and silver dominated the metal mining sector. Coal mining and the production of a wide variety of industrial minerals, which ranged from bentonite to zeolite, were also important to New Zealand's economy. In 2005, a total of $2.5 billion worth of metals, industrial minerals, and mineral fuels was mined and quarried. Owing to high commodity prices, coal production reached a decade-high level. The expenditure on exploration and development in the petroleum sector increased by 60% to $738.4 million in 2005 and was expected to continue to increase during the next several years (Ministry of Economic Development, 2006).

The Crown Minerals Act 1991 sets the broad legislative policy for prospecting, exploration, and mining of Crown-owned (meaning Government-owned on behalf of all New Zealanders) minerals in New Zealand. In 2004, the Crown Minerals Business Plan outlined two strategic priorities of the Ministry of Economic Development—to improve the security of the energy supply and to promote regional economic development. The Ministry completed the review of the minerals and fuel programs and planned to adjust regulations in a timely manner to address the needs of the rapidly changing mineral industry. The Government planned to develop an information system that would provide geotechnical information collected by Crown Minerals (Ministry of Economic Development, 2006).

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Ministry of Economic Development, 2006, Annual report 2005/2006: Wellington, New Zealand, Ministry of Economic Development, 28 p.

Major Source of Information

Ministry of Economic Development, Crown Minerals
33 Bowen St., Commerce Building
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TABLE 1

NEW ZEALAND: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2001[e]	2002	2003	2004	2005
METALS						
Aluminum metal, smelter:						
Primary		322,300 [2]	333,900	334,400	342,000 [r]	351,449
Secondary[e]		21,500	21,500	21,500	21,500	21,500
Total[e]		343,800	355,400	355,900	363,500 [r]	372,949
Gold, mine output, Au content	kilograms	9,885 [2]	9,770	9,300	10,151	10,583
Iron and steel:						
Iron sand, titaniferous magnetite, gross weight	thousand metric tons	1,636 [2]	1,740	1,947	2,329	2,207
Pig iron[e]	do.	600	600	600	650	590
Steel, crude[e]	do.	770 [2]	750	800	850	813
Lead, refinery output, secondary[e]		10,000	10,000	10,000	10,000	10,000
Silver, mine output, Ag content	kilograms	27,120 [2]	28,720	29,920	30,084	43,003
INDUSTRIAL MINERALS						
Cement, hydraulic	thousand metric tons	1,080 [r]	1,000 [r]	1,080 [r]	1,100 [r]	1,050 [e]
Clays:						
Bentonite		10,000	7,800	10,940	10,050	7,590
Kaolin, pottery		15,000	17,200	14,770	15,500 [r]	15,750
For brick and tile		70,000	47,500	56,550	57,350	41,170
Diatomaceous earth		15	20	320	240	20
Lime[e]		20,000	20,000	20,000	20,000	20,000
Marble[e]		15,000	15,000	15,000	15,000	15,000
Nitrogen, N content of ammonia		116,900 [2]	109,200	110,000 [e]	110,000 [e]	110,000 [e]
Perlite[3]		2,200	7,050	5,000	5,600	7,310
Pumice		68,000	203,700	173,400	280,950	245,080
Salt[e]		70,000 [2]	70,000	70,000	70,000	100,000
Sand and gravel:						
Silica sand, glass sand		47,500	60,150	48,400	60,080	65,350
Other industrial sand		660,000	575,700	2,207,190	1,753,140	1,574,050
For roads and ballast	thousand metric tons	18,000	18,522	18,500	21,720 [r]	24,712
For building aggregate	do.	7,500	8,026	9,267	11,362	10,921
Stone:						
Dolomite		47,500	24,720	21,920	12,000	--
Limestone and marl:						
For agriculture	thousand metric tons	2,000	2,472	2,557	1,913	2,594
For cement	do.	1,600	1,697	1,652	1,839	1,741
For other industrial uses	do.	500	865	731	561	891
Serpentine		51,500	61,300	68,960	60,880	62,320
Dimension		29,000	30,200	37,300	26,110	29,270
MINERAL FUELS AND RELATED MATERIALS						
Coal, all grades	thousand metric tons	3,911 [2]	4,459	5,180	5,154	5,267
Liquefied petroleum gas	thousand 42-gallon barrels	2,131 [r,2]	2,101 [r]	1,701 [r]	1,710 [r]	1,946
Natural gas:						
Gross production	million cubic meters	6,885 [r,2]	6,431 [r]	4,892 [r]	4,500 [r]	4,223
Marketed production	do.	6,251 [r,2]	6,431 [r]	4,492 [r]	4,114 [r]	3,911
Petroleum:						
Crude	thousand 42-gallon barrels	12,510 [r,2]	11,257 [r]	8,712 [r]	7,625 [r]	7,032
Refinery products[e]	do.	34,000	34,000	34,000	34,000	34,000

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. --Zero.

[1]Table includes data available through January 15, 2007.

[2]Reported figure.

[3]Includes zeolite.

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THE MINERAL INDUSTRY OF PAKISTAN

By Travis Q. Lyday and Staff

Pakistan is located in the northwestern section of the Indian subcontinent in South Asia and is slowly developing its mineral resources. Despite a major earthquake in 2005, the country's gross domestic product (GDP) grew at a rate of 7.0%. With a per capita GDP based on purchasing power parity of $2,628, Pakistan was still a low-income country. Inflation remained high at 9.1% (International Monetary Fund, 2006§[1]). Agriculture accounted for about 21% of the GDP and the manufacturing sector accounted for about 25%. The mining, oil, and gas industries played a minor role (1% of the GDP) in the country's economy. Pakistan's mineral resources included coal, copper, iron ore, limestone, and salt. In addition to limited oil and extensive gas reserves, hydropower has great potential as an energy resource. The major mineral commodities mined in the country were barite, bauxite, chromium, coal, dolomite, gypsum, iron ore, limestone, magnesite, marble, natural gas, petroleum, salt, and sulfur. The country also produced other mineral commodities, including cement, lead, petroleum refinery products, and steel. Pakistan is endowed with valuable gemstone deposits.

Exploitation of energy resources has been slow owing to a shortage of capital and domestic political restraints. The Government was encouraging private firms, including foreign companies, to develop the country's production capacities. The Government also continued to seek reform and privatization of the state-held electric companies.

The Pakistan Government's plans for economic development have largely taken precedence over environmental issues. Air and water pollution has contributed to major environmental and health hazards. The widespread use of low-quality fuels combined with a substantial increase in the number of vehicles on the roads has led to significant air pollution problems. Industrial waste and agricultural runoff have contaminated drinking water supplies (U.S. Energy Information Administration, 2005§).

A large copper and gold deposit at Reko Diq in Balochistan in southwestern Pakistan was identified by BHP Billiton of Australia and the Geological Survey of Pakistan in the early 1990s. Tethyan Copper Co. of Australia took over the project from BHP Billiton in 2000. The company secured a 4,000-square-kilometer prospective area. The company estimated total indicated and inferred resources to be 855 million metric tons at grades of 0.65% copper and 0.3 grams per metric ton gold at the Western Porphyries project and Tethyan Copper's wholly owned H4 Starter project. The company had identified 14 or 15 areas of known porphyry copper-gold mineralization based on sampling and geophysics surrounding the Western Porphyries and H4 Starter projects. The company aimed to place the H4 Starter project into production and to position itself among the world's top 10 copper producers. The H4 Starter project's feasibility study was scheduled to be completed in July 2005 when the company was expected to develop major infrastructure around the project, including a processing plant. The company qualified for Export Processing Zone status, the major benefits of which included tax breaks and duty-free plant and processing equipment (Australia's Paydirt, 2005).

A six-member task force was formed by the Government to privatize Pakistan Steel Mills by yearend 2005. Their mills had been planning to expand from 1.1 million metric tons per year (Mt/yr) of capacity to 1.5 Mt/yr at a cost of $2.2 billion. Austria, China, Russia, and Ukraine were interested in taking part in the expansion. The Ministry of Industries and Production opposed the expansion before the privatization, however, and wanted to let a new private investor spend money on the company's expansion (Khaleej Times Online, 2005§).

A consortium of Chinese companies (MCC Duddar Minerals Development Co. (Pvt.) Ltd.) signed a contract to borrow $54 million in loans from the China Development Bank to finance the development of the medium-sized Duddar lead and zinc mine, which is located 200 kilometers (km) north of Karachi. The bank loans made up about 80% of the total investment in the project of $72.6 million. The consortium would fund the remaining 20% of the investment from its own capital. China Metallurgical Construction Group Corp. held a 51% interest in the consortium; Hunan Zhuzhou Nonferrous Metals Smelter Co. Ltd., 34%; and Hunan Huangshaping Lead and Zinc Mine Co., 15%. The project had a mining and concentrating capacity of 660,000 metric tons per year (t/yr) to produce 32,600 t/yr of lead concentrate and 100,400 t/yr of zinc concentrate. The project was to begin construction in April 2005 and would begin commercial production by the end of 2007 (China Daily, 2005§).

Projects were being planned in the energy sector for natural gas transport and supply and electricity generation. Sui Northern Gas Pipeline Ltd. and Sui Southern Gas Co. Ltd. signed a 15-year agreement for the transportation of natural gas from Hasan Gasfield to a compression station at Sui in the Province of Balochistan. Sui Southern Gas offered to construct a 270-km pipeline to carry gas from Nawabshah in the Province of Sindh to Sui. The transmission capacity would be 850,000 cubic meters per day. The transportation cost was estimated to be $9.25 million per year (Pakistan Petroleum Ltd., 2005).

Of particular interest was the country's plan to build a $7.4 billion natural gas pipeline that would span from Iran's massive reserves to Indian markets across Pakistani territory. Gazprom of Russia was interested and indicated its desire to invest in the project. Pakistan could earn about $70 million per year in transit fees from the pipeline (U.S. Energy Information Administration, 2005§).

The Government granted Shenhua Group of China permission to build two coal-fired powerplants at Thar in the Province of Sindh to supply 600 megawatts of electricity. The plan was to exploit the large untapped coal reserves in Tharkparkar. Pakistan

[1]References that include a section mark (§) are found in the Internet References Cited section.

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sought the personal intervention of the Chinese prime minister to help start the project. About $1.85 billion spent on the project would be wasted if Shenhua Group did not start work on the project in 2005 (Petroleum Economist, 2005).

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TABLE 1
PAKISTAN: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2001	2002	2003	2004	2005
METALS						
Aluminum, bauxite, gross weight		3,728 r	12,233 r	4,098 r	4,847	6,504
Chromium ore:						
Gross weight		21,683 r	24,185 r	30,657 r	29,230 r	46,359
Cr_2O_3 content[e]		9,800 r	10,900 r	13,800 r	13,200 r	20,900
Iron and steel:						
Iron ore, gross weight	thousand metric tons	24,765 r	4,942 r	11,773 r	84,946 r	104,278
Steel, crude[e]	do.	500	550	550	600	700
Lead, refined, secondary[e]		2,000	2,100	2,330	3,000 [2]	3,200
INDUSTRIAL MINERALS						
Abrasives, natural, emery[e]		150	150	150	150	150
Barite		28,289 r	21,451 r	40,745 r	44,207 r	42,087
Cement, hydraulic[e]	thousand metric tons	9,900	10,300	10,300	10,400	10,600
Chalk		7,630 r	7,881 r	7,752 r	7,735 r	8,146
Clays:						
Bentonite		13,935 r	11,476 r	11,290 r	6,316 r	15,671
Fire clay		163,723 r	174,429 r	120,243 r	192,728 r	253,501
Fuller's earth		12,426 r	15,521 r	16,670 r	13,986 r	17,001
Kaolin, china clay		46,574 r	53,542 r	39,575 r	25,204 r	37,732
Other[e]		200,000	209,000	210,000	212,000 r	215,000
Feldspar		41,275 r	35,071 r	37,344 r	30,373 r	25,032
Fluorspar[e]		1,000	1,000	1,000	1,026 [2]	1,040
Gypsum, crude		399,097 r	401,748 r	424,107 r	467,065 r	552,496
Magnesite, crude		4,695 r	4,637 r	2,645 r	6,074 r	3,029
Nitrogen, N content of ammonia[e]		1,966,100 [2]	2,050,000	2,050,000	2,050,000	2,100,000
Phosphate rock:						
Gross weight		2,385 r	1,362 r	2,562 r	4,614 r	2,687
P_2O_5 content[e]		430 r	250 r	470 r	840 r	490
Pigments, mineral, natural, ocher[e]		4,800	5,000	5,000	5,000	5,500
Salt:						
Rock	thousand metric tons	1,394 r	1,423 r	1,426 r	1,640 r	1,648
Marine	do.	15 r	14 r	17 r	12 r	14
Total	do.	1,409 r	1,437 r	1,443 r	1,652 r	1,662
Sand:						
Bajir and common		13,580 r	-- r	-- r	-- r	--
Glass[e]		165,000	172,000	75,000 r	-- r,2	-- [2]
Sodium compounds, n.e.s.:[e]						
Caustic soda		220,000	230,000	230,000	230,000	250,000
Soda ash, manufactured		230,000	240,000	240,000	240,000	260,000
Stone:						
Aragonite and marble		634,283 r	685,258 r	1,066,276 r	993,558 r	1,280,304
Dolomite		352,689 r	312,886 r	340,864 r	297,419 r	199,653
Limestone	thousand metric tons	13,108 r	10,820 r	11,880 r	13,150 r	14,857
Other, as "ordinary stone"	do.	1 r	1 r	2 r	4 r	6
Strontium minerals, celestite		807 r	382 r	402 r	570 r	1,855
Sulfur:						
Native		17,428 r	22,580 r	19,402 r	23,873 r	24,158
Byproduct, all sources		-- r	-- r	-- r	-- r	--
Total		17,428 r	22,580 r	19,402 r	23,873 r	24,158
Talc and related materials, soapstone		46,989 r	53,573 r	65,813 r	52,483 r	20,564

See footnotes at end of table.

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TABLE 1--Continued
PAKISTAN: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2001	2002	2003	2004	2005
MINERAL FUELS AND RELATED MATERIALS						
Coal, all grades	thousand metric tons	3,286 r	3,512 r	3,609 r	3,325 r	3,367
Coke[e]	do.	900	950	500 r	-- r, 2	-- [2]
Gas, natural:						
Gross production	million cubic meters	24,793 r	26,161 r	28,111 r	34,063 r	38,089
Marketed production, sales[e]	do.	21,000	22,000	24,000 r	30,000 r	34,000
Natural gas liquids[e]	thousand 42-gallon barrels	600	650	650	650	700
Petroleum:						
Crude	do.	21,084 r	23,195 r	23,458 r	22,625 r	24,119
Refinery products:						
Gasoline	do.	8,818 r	9,809 r	8,013 r	9,616 r	9,959
Jet fuel	do.	5,463 r	5,747 r	6,388 r	7,432 r	8,833
Kerosene	do.	3,210 r	2,704 r	2,118 r	1,794 r	1,511
Distillate fuel oil	do.	18,456 r	20,610 r	21,893 r	24,315 r	26,857
Residual fuel oil	do.	22,399 r	23,495 r	22,832 r	22,794 r	23,346
Lubricants	do.	1,326 r	1,379 r	1,319 r	1,334 r	1,401
Other	do.	5,583 r	6,395 r	7,066 r	9,251 r	10,264
Total	do.	65,255 r	70,139 r	69,629 r	76,536 r	82,171

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. --Zero.

[1]Table includes data available through January 11, 2007.

[2]Reported figure.

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THE MINERAL INDUSTRY OF PAPUA NEW GUINEA

By Travis Q. Lyday and Staff

Papua New Guinea, which comprises the eastern one-half of New Guinea Island and about 600 smaller islets, atolls, and coral reefs, is located east of Indonesia and north of Australia between the Coral Sea and the South Pacific Ocean. Papua New Guinea's total area of 462,840 square kilometers (km^2), which is slightly larger than the State of California, includes 452,860 km^2 of land area and 9,980 km^2 of water area. The country's population in 2005 was about 5.6 million. The country's gross domestic product (GDP) based on purchasing power parity was estimated to be $13.6 billion in 2005, and its per capita GDP based on purchasing power parity, to be $2,357 (International Monetary Fund, 2006§[1]; U.S. Central Intelligence Agency, 2006§).

Papua New Guinea is rich in mineral resources, the major ones of which are cobalt, copper, natural gas, gold, nickel, crude petroleum, and silver. The major minerals produced during the past 5 years were copper, natural gas, gold, petroleum, and silver. In 2005, Papua New Guinea ranked fourth in the Asia and the Pacific region in the mine production of copper, gold, and silver (World Bureau of Metal Statistics, 2006, p. 37, 79, 119).

Mining was an important sector of Papua New Guinea's economy. Mineral production accounted for 25.3% of the country's GDP in 2000 and was estimated to have accounted for 20.8% in 2004. In 2004, the export value of minerals, which included copper, gold, petroleum, and silver, totaled $1,863.2 million and accounted for 73% of total export earnings (International Monetary Fund, 2006, p. 38, 56). In 2005, according to an estimate by GlobalEdge, Papua New Guinea's mineral export receipts accounted for 49.7% of the country's GDP and minerals production accounted for 20% of the country's Government revenue (Australia Broadcasting Corporation, 2006§; GlobalEdge, 2006§).

In 2005, copper ore and concentrate were produced by Ok Tedi Mining Ltd. from a copper-gold ore body at Mount Fubilan in the Star Mountain region of Western Province near the border of West Papua. The total ore mined decreased by 1% to 26 million metric tons (Mt), and copper concentrates production increased by 5.8% to 664,041 metric tons (t); the grades of head grade copper and head grade gold mined were 0.89% and 0.97 grams per metric ton (g/t), respectively. The amount of copper, gold, and silver contained in copper concentrate was 192,978 t, 14,867 kilograms (kg), and 40,984 kg, respectively. Copper concentrates from the mine were exported to, in decreasing order of amount exported, Japan, the Republic of Korea, China, the Philippines, India, and Germany. As of December 2005, the estimated resources of copper at the Ok Tedi Mine totaled 854 Mt at grades of 0.63% copper and 0.78 g/t gold. Of the estimated resources, the estimated ore reserves (proven and probable) totaled 214 Mt at grades of 0.85% copper and 1.11 g/t gold (Ok Tedi Mining Ltd., 2006§). Ok Tedi Mining was owned by PNG Sustainable Development Program Ltd. (52%), the Government (30%), and Inmet Mining Corp. of Canada (18%).

In 2005, major gold and silver mining activities took place at the Lihir and the Mt. Kare mines (gold), the Ok Tedi Mine (copper and gold), and the Porgera Mine (gold and silver). The Misima Mine, which had been operated by Placer Dome Inc. of Canada, was officially closed in 2004. The Misima open pit gold and silver mining operations had been stopped in 2001 owing to the depletion of the ore reserves but Placer Dome continued to produce gold and silver by processing low-grade stockpiled ore until 2004 (Mining-Technology.com, 2006§).

Crude petroleum was produced by Chevron Niugini Ltd. mainly from the Central Moran Oilfield, the Gobe Oilfield, and the Kutubu Oilfield in Southern Highlands Province and from onshore Papua Basin. Santos Ltd. also produced a smaller quantity of crude petroleum from the SE Gobe Oilfield in Southern Highlands Province and from Papua Basin.

In June 2004, the country's first and only oil refinery was completed and brought onstream by InterOil Corporation of Canada at an estimated cost of $214 million. The refinery, which is located in the Port Moresby area, has a capacity of 32,500 barrels per day. The refinery consists of atmospheric distillation and a modest catalytic reformer for the production of gasoline blend stock. Prior to 2005, the country imported all its refined petroleum products from Australia and Singapore. According to the company, the refinery was capable not only of meeting the country's domestic requirements but of providing products for export as well (InterOil Corporation, 2004§; 2005§).

Outlook

Papua New Guinea's economy was forecasted to grow steadily at a rate of 4.5% in 2006 and 5.0% in 2007 (International Monetary Fund, 2006§). The future activities of the mining sector, however, could be negatively affected by increasing mining-related pollution and tribal attacks against multinational mining, oil, and gas installations in highlands areas. After the 2005 expansion in the mining sector because of higher metals prices, copper and gold production are expected to stagnate during the next 2 years because of the depleting ore reserves of copper and gold at the Ok Tedi copper mine and at the Porgera gold mine. A future decline in the price of copper would have a negative impact on the continued growth of the mining sector (Asian Development Bank, 2005§).

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TABLE 1
PAPUA NEW GUINEA: PRODUCTION OF MINERAL COMMODITIES[1]

Commodity[2]		2001	2002	2003	2004	2005
Copper, mine output, Cu content	metric tons	203,762	204,000	205,500	177,200	193,000
Gas, natural	million cubic meters	1,434	1,450 e	1,450 e	1,450 e	1,365
Gold, mine output, Au content	kilograms	67,043	61,379 r	67,832 r	69,027 r	66,700
Natural gas liquids e	42-gallon barrels	186,190 r	200,000	200,000	200,000	200,000
Petroleum, crude	thousand 42-gallon barrels	20,423	21,722 r	17,340	16,790	16,800
Silver, mine output, Ag content	kilograms	69,368	63,349 r	61,900 r	53,800 r	62,600

eEstimated; estimated data are rounded to no more than three significant digits. rRevised.

[1]Includes data available through November 1, 2006.

[2]In addition to the commodities listed, cement and crude construction materials (common clays, sand and gravel, and stone) are produced, but available information is inadequate to make reliable estimates of output.

[3]Reported figure.

Sources: U.S. Geological Survey, Minerals Questionnaire 2001-03. Bristish Geological Survey, World Mineral Production 2000-04. International Copper Study Group, Copper Bulletin, July 2006. Oil & Gas Journal, Worldwide Look at Reserves and Production, v. 101, no. 49, December 22, 2003; v. 103, no. 47, December 19, 2005, and Statistics Worldwide Crude Oil and Gas Production, March 12, 2006.

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THE MINERAL INDUSTRY OF THE PHILIPPINES

By Yolanda Fong-Sam

The Republic of the Philippines is located in southeastern Asia between Taiwan to the north and Indonesia to the south and is bordered by the Philippine Sea to the east and the South China Sea to the west. The country is an archipelago made up of more than 7,100 islands with a land area of approximately 300,000 square kilometers (km²); the major island groupings are the Luzon islands in the north, the central Visayan Islands, and the Mindanao islands in the south. The country had an estimated population of 83.1 million in 2005 (World Bank Group, 2005§[1]; U.S. Central Intelligence Agency, 2006§). According to the International Monetary Fund (2005§), the Philippines gross domestic product (GDP) based on purchasing power parity was estimated to be $409.5 billion, and the GDP per capita based on purchasing power parity was estimated to be about $4,770.

Mineral resources of the Philippines included cement, chromium, copper, gold, marine salt, nickel, and silver. During 2005, exports from the Philippines totaled about $41.26 billion, and imports totaled about $47.42 billion. Mineral exports of cathodes, sections of cathodes of refined copper, and petroleum products totaled $946.87 million, which represented about 2.3% of the total exports during 2005. For the same period, imports of iron and steel, and mineral fuels and related materials totaled $7.66 billion, which was equivalent to about 16.15% of the total imports (National Statistics Office of the Philippines, 2005§).

In December 2004, the Philippines achieved a major success in its effort to revitalize the mining industry when the Supreme Court of the Philippines reversed an earlier (January 2004) decision and confirmed the legality of the 1995 Philippine Mining Act, including the Financial or Technical Assistance Agreement (FTAA), which regulates the mineral resources development, maintains an inventory of mineral reserves, and promotes direct investments in mineral exploration and development activities in the Philippines. The act also promotes the revitalization of the mining industry by providing fiscal reforms and incentives. It allows 100% foreign equity in mining projects through FTAAs and the participation of foreign corporations in mineral development, exploration, and processing. Preceding the December 2004 decision, in 1997, a group of nongovernmental organizations (NGOs) had asked the Supreme Court to nullify the 1995 Philippine Mining Act and the FTAA, which allowed the direct participation of foreign-owned corporations in the mining industry of the Philippines. The NGOs claimed that the Act's provisions were unconstitutional. In late 2003, the President of the Philippines announced that the Philippine Government would promote the development of the mining industry; as a result, in January 2004, the President issued an executive order that provided for a policy framework to revitalize the industry. The Government proposed a Minerals Action Plan (MAP), which simplifies the mining permit process to reduce the length of time needed for investors to receive the approvals for a mineral production agreement in this country. The average waiting period of 3 to 5 years was reduced to 6 months (Mining Journal, 2005a; 2006b).

By late January 2005, the Supreme Court had ruled with finality on the constitutionality of the 1995 Philippine Mining Act. In February 2005, the Philippine Chamber of Mines organized an international investment mining conference to promote the revitalization of the mining sector by announcing the resolution of the constitutionality of the country's mining act and the changes in regulatory requirements for mining prospectors. The conference resulted in 29 memorandums of understanding and letters of intent with local and international partners, and generated commitments of an estimated $5 billion in new investment (Mining Journal, 2005a, p. 20; 2005b, p. 24).

In December 2004, the total number of operating mines and quarries in the Philippines was tallied at 2,311. They included two large-scale gold mines, the Teresa and the Victoria, which were owned by Lepanto Consolidated Mining Corporation; four medium-scale gold mines, which included the Acupan (owned by SSM Operations and Benguet Corp.), the Banahaw (owned by Philsaga Mining Corp.), the Canatuan (owned by TVI Resources Philippines, Inc.), and the Diwalwal (owned by NRMDC, a direct state development project); one large-scale copper mine, the Padcal (owned by Philex Mining Corporation); four medium-scale nickel mines, which included the Cagdianao (owned by Cagdianao Mining Corp.), the Palawan (owned by Rio Tuba Mining Corp.), the South Dinagat (owned by Hinatuan Mining Corp.), and the Taganito (owned by Taganito Mining Corp.); and four medium-scale chromite mines, which included the Dinagat (owned by Krominco), the Homonhon (owned by Heritage Resources Mining Corp.), the Masinloc (owned by Benguet Corp.), and the Omasdang (owned by Crau Minerals). By December 31, 2005, a total of 762 mining rights were issued by the Government of the Philippines. During the past few years, the Philippines has seen significant progress in the mining exploration sector that has resulted in the discovery of important deposits, such as the Boyangan and the Tampakan deposits for copper and the Far Southeast deposit for copper and gold (Mining Journal, 2006a).

Outlook

The development of the mining industry in the Philippines is likely to increase in 2006 and during the next few years given the new interest in the industry since the Philippines started its mining revitalization process.

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TABLE 1

PHILIPPINES: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2001[e]	2002[e]	2003[e]	2004	2005
METALS						
Chromium, chromite, gross weight		27,930 [e, 3]	22,000 [e, 3]	33,780 [e, 3]	42,140 [r]	36,070
Copper:						
Mine output, Cu content		20,322 [3]	18,364 [3]	20,414 [3]	15,984	16,320
Metal:						
Smelter		216,634 [3]	137,800 [3]	111,600 [3]	120,000 [r]	170,000
Refined		164,530 [3]	144,315 [3]	171,152 [3]	174,628	172,000
Gold, mine output, Au content	kilograms	33,840 [3]	35,850 [3]	37,844 [3]	35,464	37,490
Iron and steel, steel, crude[e]	thousand metric tons	530 [3]	530	550	550	550
Lead, metal, secondary refined		24,000	26,000 [e, 3]	27,000 [e, 3]	29,000 [r]	30,000
Nickel, mine output, Ni content		23,100 [3]	24,148 [3]	19,537 [3]	16,973	22,560
Silver, mine output, Ag content	kilograms	33,600	8,800	9,533 [3]	9,315	19,150
INDUSTRIAL MINERALS						
Cement, hydraulic	thousand metric tons	8,653 [3]	13,400 [e, 3]	13,067 [e, 3]	13,346	15,494
Clays:						
Bentonite		5,128 [3]	5,500	5,500	3,560 [r]	--
Red		4,983 [3]	5,000	5,000	8,920 [r]	3,530
White		5,111 [3]	5,000	5,000	13,310 [r]	12,220
Other[e]		800	800	800	6,500 [r]	13,400
Feldspar		33,122 [3]	30,000	30,000	32,110 [r]	11,850
Lime[e]		9,000	9,000	9,000	9,000	9,000
Perlite[e]		6,000	6,000	6,000	5,510 [e, 3]	4,410 [3]
Phosphate rock[e]		450,000	400,000	400,000	400,000	400,000
Pyrite and pyrrhotite, including cuprous, gross weight[e]		300,000	300,000	300,000	300,000	300,000
Salt, marine		600,000	600,000	429,160 [3]	427,620 [r]	420,950
Sand and gravel:						
Silica sand	thousand metric tons	170 [r]	170 [r]	170 [r]	237 [r]	224
Other[e, 4]	thousand cubic meters	15,000	15,000	15,000	36,133 [e, 3]	36,792 [3]
Stone:[e]						
Dolomite		802,189 [3]	800,000	750,000	1,408,870 [e, 3]	874,730 [3]
Limestone[5]	thousand metric tons	23,000	20,000	16,432 [3]	20,959 [e, 3]	21,236 [3]
Marble, dimension, unfinished	cubic meters	15,000	15,000	15,000	4,740 [e, 3]	5,120 [3]
Volcanic cinder	do.	2,000	2,000	2,000	8,470 [e, 3]	8,660 [3]
Tuff		1,500	1,500	1,500	19,250 [e, 3]	17,850 [3]
Quartz		50,000	50,000	50,000	50,000 [e]	50,000 [e]
Crushed, broken, other[6]	thousand cubic meters	2,500	2,500	2,500	2,500 [e]	2,500 [e]
Sulfur, all forms[e]		170,000	180,000	180,000	180,000	180,000

See footnotes at end of table.

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TABLE 1--Continued
PHILIPPINES: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2001[e]	2002[e]	2003[e]	2004	2005
MINERAL FUELS AND RELATED MATERIALS						
Coal, all grades	thousand metric tons	1,230 [3]	1,665 [3]	2,029 [3]	2,727 [r]	3,165
Petroleum:						
Crude	thousand 42-gallon barrels	475 [3]	2,020 [3]	2,000	139 [r]	208
Refinery products:[e]						
Liquefied petroleum gas	do.	6,000	25,200	25,200	30,600 [r, 3]	31,000
Gasoline	do.	19,000	79,800	79,800	127,600 [r, 3]	128,000
Jet fuel	do.	7,000	29,400	29,400	45,800 [r, 3]	46,000
Kerosene	do.	5,000	21,000	21,000	17,700 [r, 3]	18,000
Distillate fuel oil	do.	40,000	168,000	168,000	170,000	170,000
Residual fuel oil	do.	47,000	215,000	215,000	234,200 [r, 3]	234,000
Refinery fuel and losses	do.	5,000	230,000	230,000	230,000	230,000
Other	do.	10,000	225,000	225,000	225,000	225,000
Total	do.	139,000	993,000 [r]	993,000	996,000	1,100,000

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. -- Zero.

[1]Table includes data available through February 2007.

[2]In addition to the commodities listed, the Philippines produces platinum-group metals as byproducts of other metal production, but available information is inadequate to make estimates of output.

[3]Reported.

[4]Includes "pebbles" and "soil" not further described.

[5]Excludes limestone for road construction.

[6]Includes materials described as rock, crushed or broken; stones, cobbles, and boulders; rock aggregates; and broken adobe.

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The Mineral Industry of Singapore

By Pui-Kwan Tse

Known as the "Lion City," Singapore has been transformed from an impoverished island in Southeast Asia with no natural resources into one of the richest economies in the Asia and the Pacific region. The city-state identifies itself as the place where Asia and the West meet. It is located at the entrance to the Strait of Malacca, which has become one of most important transshipping centers in the world. Singapore also is a leader in the development of new biotechnologies, the manufacturing of electronic components, and petroleum refining.

With a total population of about 4.2 million, the country was considered to be a politically stable and well-regulated place to do business (Singapore Department of Statistics, 2005, p. v). Singapore is consistently rated as having one of the best environments for investment in the world. The Singapore economy recovered well from the effects of Severe Acute Respiratory Syndrome (SARS) in 2003. The gross domestic product expanded by 6.4% to $117.1 billion in 2005 after having increased by 8.7% to $109.5 billion in 2004. The consumer price index changed by 0.5% in 2005 compared with 1.7% in 2004. The continuing surge in oil prices in the world market in 2005 contributed to the increase in consumer prices, although a decline in prices of information technology components helped offset the higher oil prices. Economic growth for the year, however, was mainly the result of recovery in the manufacturing and service sectors. Increased global demand for electronics (which is expected to continue to grow for the next 2 years) led to an increase in exports of electronics, which accounted for about 40% of Singapore's total trade (Ministry of Trade and Industry, 2006, p. 117). The increase of external demand could encourage domestic companies to increase capital spending, which could boost domestic demand in the future. The construction sector declined for the sixth consecutive year.

Total foreign trade increased by 14% to $431.1 billion in 2005, of which the value of exports was $230.4 billion and imports was $200.7 billion. The double-digit growth in total trade was generated by the strong economic growth in China and India, where Singapore's nonelectronics and nonoil products were in demand. Malaysia remained Singapore's leading export destination followed by the United States, Indonesia, Hong Kong, and China. Malaysia was the leading source of Singapore imports followed by the United States, China, Japan, and Taiwan. Electronics, chemicals, and petroleum were Singapore's leading export products. On August 1, 2005, Singapore and India signed a comprehensive economic cooperation agreement that allowed Singaporean enterprises to expand their market access to the South Asian countries. As member of the Association of Southeast Asian Nations (ASEAN), Singapore was negotiating free trade agreements with such countries as Australia, China, Japan, the Republic of Korea, and New Zealand. Member countries of ASEAN agreed to accelerate the movement toward free trade in the region by 2015 (Ministry of Trade and Industry, 2006, p. 149-165).

In 2004, NatSteel Ltd., which was the leading steel company in Singapore, agreed to sell its entire steel business to Tata Iron and Steel Co. of India for $283 million. The company had a design output capacity of 600,000 metric tons (t) of crude steel from its 80-t electric-arc furnace (EAF) in Singapore. NatSteel had a 46% interest in Southern NatSteel (Xiamen) Ltd. in China, a 26% equity share in Southern Steel Bhd. in Malaysia, and other assets in Thailand and Vietnam. NatSteel was renamed NatSteel Asia Pte Ltd. in 2005. NatSteel was expected to import billet from Tata's plants in India instead of using scrap for its EAF. Singapore consumed about 800,000 metric tons per year (t/yr) of steel products (Metal Bulletin, 2004).

In 2005, KJP International Pte Ltd. and Yunnan Tin Co. Ltd. of China jointly built a tin refining plant, Singapore Tin Industries Pte Ltd. (STI), in Singapore. The twin-production-line plant was designed to have an output capacity of 36,000 t/yr of tin. STI used the crystallization refining method, which was used in Yunnan Tin to remove impurities from crude tin mainly from Indonesia. STI planned to build a smelting plant in Banka, Indonesia, that would have a smelting capacity of 12,000 t/yr in 2006. STI also planned to produce such downstream products as tin dioxide, tin sulfate, and tin-based chemical products at its Singapore site in 2006 (Metal Bulletin, 2006).

Because the country has no mineral fuels, about 80% of Singapore's electricity was generated by natural gas that was imported via pipelines from Indonesia and Malaysia. The demand for electricity was expected to increase, and the demand for natural gas was expected to exceed supply in the future. The Government considered importing liquefied natural gas (LNG) to meet future demand for gas. The Energy Market Authority contracted Tokyo Gas Engineering Co. Ltd. to undertake a feasibility study for the construction of an LNG terminal in Singapore (Energy Market Authority, 2005).

Singapore has become a major hub for the international chemical sector. Chemicals, petroleum, and petroleum products were Singapore's leading exports and reexports after electronics. In 2005, the export value of petroleum and petroleum products totaled more than $34.6 billion, which was about 15% of the total value of exports. The Government planned to increase the output share of the petrochemical products in the manufacturing industry to 30% in 2010. Petroleum refining accounted for 57% of the chemical sector's production. Four oil refining companies that operated in the country—Exxon Mobil Corp., Royal Dutch/Shell Co., Singapore Petroleum Co., and Singapore Refinery Co.—had a combined output capacity of about 1.3 million barrels per day. Major multinational petrochemical companies, such as BASF Group, ChevronTexaco Corp., ExxonMobil, Mitsui Chemical Co., Royal Dutch/Shell, and Sumitomo Chemical Co., had set up plants on the island.

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The Mineral Industry of Sri Lanka

By Chin S. Kuo

The December 2004 Indian Ocean earthquake and tsunami caused an estimated $1.5 billion worth of damage in Sri Lanka. The tsunami's overall economic impact was less severe than first thought and the economy was stable. The real gross domestic product (GDP) growth of 5.9% in 2005 was achieved with the help of a strong global demand for Sri Lanka's exports and effective aid utilization in the reconstruction effort. The per capita GDP based on purchasing power parity was $4,383, and inflation remained high at 10.6% (International Monetary Fund, 2006§[1]). The service sector contributed 55.2% of the GDP; industry contributed 27.1%; and agriculture, 17.7%. The tourism industry suffered in 2005 following the tsunami. Industrial output from mining and quarrying accounted for only about 1% of the GDP. The country is endowed with industrial mineral resources and has no metal or mineral fuel resources.

The Government's economic policies focused on alleviating poverty and steering investment to disadvantaged areas, developing the small- and medium-enterprise sector, promoting agricultural production, and expanding the already enormous civil service. The Government planned to retain ownership and management of state enterprises and make them profitable (U.S. Department of State, 2006).

In a study of the world's ilmenite and rutile mining provinces, rocks associated with titanium minerals were recognized in South India and Sri Lanka. Placers at Pumoddai and Putallam in western Sri Lanka have accumulated on the Wanni Terrance coast, which is underlain by granulite and amphibolite facies charnokites and granites. The Highland Terrain, which is full of granulite charnokites, khondalites, and metasediments, runs northeast-southwest through central Sri Lanka. The longest southeasterly running Vijayan Terrain consists of mostly amphibolite-grade metasediments (Stanaway, 2005).

Gemstone mining activity in Sri Lanka increased slightly in 2005. The number of licenses for mining in the Bagawanthalawa, the Kalutara, and the Ratnapura areas and mine output of gemstone both increased slightly compared with those of 2004. Mining at the Bagawanthalawa gemstone deposits stopped following a court injunction. Mud from mining was silting the Castlereagh reservoir, which was a source of hydroelectricity for Sri Lanka. The deposits were one of the richest sources of blue, orange-yellow, and yellow sapphires and alexandrite and chrysoberyl cat's eye (Jewellery News Asia, 2005).

The Government has conducted studies in the past that indicate some evidence of small hydrocarbon reserves in the northwestern Gulf of Mannar and in Cauvery. The Government has delayed plans to invite exploration and development companies to bid for oil and gas rights for several years owing to political turmoil. A licensing round for oil exploration could take place in the first quarter of 2006 (Schlumberger, 2005§).

Preliminary findings of a seismic survey conducted by the Government in the Gulf of Mannar revealed the presence of a world-class petroleum system off the island. The prospect was explored further through two-dimensional seismic survey in December 2005, and international licensing was scheduled for the first quarter of 2006 (Petroleum Economist, 2005).

Ceylon Petroleum Corp. planned to build and operate a second oil refinery, which would lower the country's reliance on imported petroleum products. A 100,000-barrel-per-day (bbl/d) plant would be built adjacent to the existing 51,000-bbl/d Sapugaskanda refinery near Colombo. The refinery was expected to take 4 years to build at a cost of $795 million, which would be privately funded. Most of the refinery's output would be for the domestic market. Global Energy of the United States was to lead the project (Platts, 2005§).

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Colombo 3, Sri Lanka

Geological Survey and Mines Bureau
4 Galle Road
Dehiwala, Sri Lanka

Lanka Ceramic Ltd.
Colombo, Sri Lanka

State Gem Corp.
Colombo, Sri Lanka

State Mining and Mineral Development Corp.
Colombo, Sri Lanka

[1]References that include a section mark (§) are found in the Internet References Cited section.

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TABLE 1
SRI LANKA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2001	2002	2003	2004[e]	2005[e]
Cement, hydraulic	thousand metric tons	1,108	1,018	1,164	1,400	1,500
Clays:						
Ball clay		24,846	28,431	33,405	34,000	36,000
Kaolin		9,403	8,613	9,073	9,200	9,400
Brick and tile clay[e]		8,000	8,000	8,000	8,000	8,000
Clays for cement manufacture[e]		850	850	900	900	950
Feldspar, crude and ground		27,438	28,866	32,586	33,000	34,000
Gemstones, precious and semiprecious, other than diamond, value	thousands	$57,530	$54,604	$96,797	$99,000	$101,000
Cats eye	carats	NA	36,891	45,228	46,000	47,000
Ruby	do.	NA	23,000	12,934	15,000	17,000
Star ruby	do.	NA	NA	NA	NA	NA
Sapphire	do.	NA	344,900	773,547	780,000	785,000
Star sapphire	do.	NA	NA	NA	NA	NA
Other	do.	NA	4,110,400	1,828,400	1,900,000	2,000,000
Graphite, all grades		6,585	3,619	3,387	3,400	3,000
Iron and steel, metal, semimanufactures[e]		51,000	50,000	50,000	50,000	50,000
Mica, scrap		1,161	1,161	1,674	1,700	1,700
Petroleum refinery products:[e]						
Gasoline	thousand 42-gallon barrels	2,000	2,100	2,100	2,100	2,200
Jet fuel	do.	600	600	650	650	650
Kerosene	do.	1,500	1,500	1,500	1,500	1,500
Distillate fuel oil	do.	4,800	4,900	5,000	5,100	5,200
Residual fuel oil	do.	5,200	5,200	5,200	5,100	5,100
Refinery fuel and losses	do.	680	700	710	720	720
Other	do.	2,000	2,000	2,050	2,100	2,200
Total	do.	16,800	17,000	17,200	17,300	17,600
Phosphate rock, gross weight		35,440	38,775	41,357	42,000	43,000
Salt		130,272	73,274	78,713	79,000	80,000
Stone:						
Limestone	thousand metric tons	819	848	991	1,000	1,010
Quartzite		15,731	7,857	18,139	20,000	22,000

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. NA Not available.

[1]Table includes data available through October 3, 2006.

[2]In addition to the commodities listed, crude construction materials, such as sand and gravel, and varieties of stone presumably are produced, but available information is inadequate to make reliable estimates of output levels.

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THE MINERAL INDUSTRY OF TAIWAN

By Pui-Kwan Tse

Taiwan is an island that is located south of Japan and east of mainland China in the Pacific Ocean. The island's economy was export oriented and the growth prospects of its economy depended on the world economy. During the past three decades, Taiwan has transformed from a developing area into a developed area. According to the Council for Economic Planning and Development, the output of the service sector accounted for 70% of the island's gross domestic product (GDP) in 2005, and the manufacturing sector, for 24%. During the period between 1950 and 1964, the iron and steel and shipbuilding sectors were the backbone of the island's economic growth. Automotive products, consumer electronics, and home appliances were the major industries between 1965 and 1974. The automated machinery and microelectronics sectors flourished during the period between 1975 and 1990. Since then, the service sector has been the engine for economic growth. In the first 8 months of 2005, Taiwan's manufacturing productivity index, technological progress, and production efficiency increased by 0.75%, which was the lowest rate of growth in the past 21 years. The productivity of traditional manufacturing industries declined in 2005. The productivity of such hi-tech manufacturing industries as electronic components and precision optical equipment also posted a decline. The mining sector accounted for only about 0.1% of the total industrial production output value. According to the Taiwan authorities' industrial survey of manufacturers, about one-third of enterprises indicated that the investment environment in Taiwan declined in 2005. Taiwan relied on domestic consumers and especially on exports to drive economic growth. In 2005, the island's GDP increased by 4.03% to $346.4 billon and the per capita income of the island's 22.6 million people increased to $15,291 (Directorate General of Budget, Accounting, and Statistics, 2006, p. 30).

Because it has limited mineral resources, Taiwan imported various minerals to meet its increasing demand. In 2005, the production index for the mining sector decreased by 9.43% compared with that of 2004. The manufacturing output value of mineral fuels, industrial minerals, and metals accounted for about 22.0% of the total output value. Domestic fuel supplies accounted for less than 2% of the island's total fuels demand. Iron and steel was the leading metal production sector on the island. The production of other value-added manufacturing products, such as those made of aluminum and copper, depended upon imported metals and scrap (Directorate General of Budget, Accounting, and Statistics, 2006, p. 36).

During the past decade, the number of manufacturing factories has been on the decline. Such traditional industries as chemicals, electronic components, electric and metal machinery, and textiles were either shut down or operation facilities were relocated to countries with lower production costs, such as China and the countries of Southeast Asia. Taiwan's Ministry of Economic Affairs (MOEA) announced that, starting on January 1, 2006, Taiwan authorities would provide $5.95 billion in loans to attract overseas Taiwanese producers to invest more at home. An $8.5 billion development fund would be used to acquire land in the industrial zone for private investors. MOEA also developed guidelines and action plans to promote the knowledge-intensive service sector as the new catalyst for economic growth in the next decade despite fierce global competition. The Taiwan authorities believed that high levels of service sector development could add value to products in the agricultural and manufacturing sectors, improve Taiwan's core competitive edge, and strengthen the industrial sector. The improvement of service would encourage Taiwanese businesses to stay in Taiwan and would attract foreign businesses to set up global logistics centers in Taiwan. Developing such service industries as entertainment, environmental protection, medicine and healthcare, tourism, and sports recreation could enhance the quality of life in Taiwan (China Post, 2005§[1]).

Trade

In 2005, Taiwan's total trade increased by 8.5% to $381.0 billion. The values of exports and imports increased to $198.4 billion and $182.6 billion, respectively. Crude oil remained the leading imported mineral commodity by value and was followed by coal, natural gas, iron ore, marble, and kaolin. Taiwan's leading exports were products of capital- and technology-intensive sectors and included base-metal products, electrical equipment, musical instruments, and precision instruments. Traditional labor-intensive products, such as cement, footwear, and textiles, had decreased significantly during the past decade in terms of export value and percentage share of total exports. Many of Taiwan's labor-intensive industries set up plants in mainland China during the past decade. They either focused on the Chinese market to take advantage of its overwhelming growth in consumption or received their orders from Taiwan, produced their goods in mainland China, and then shipped the goods to overseas buyers. Together, China and Hong Kong were Taiwan's leading destinations for exports in 2005. According to the Directorate General of Customs, exports to these areas increased by 12.2% to $71.61 billion, or 36.1% of the total export value. China was Taiwan's leading foreign investment destination. In 2005, China had approved 3,907 Taiwan-investment projects with a total contractual value of $10.36 billion. During the past several years, about 60% of Taiwan's steel exports were shipped to China. Shipments of merchandise across the Taiwan strait must be transshipped through third ports, mainly Hong Kong. Japan was Taiwan's leading importing country. Taiwan's total trade with Japan was $61.2 billion followed by the United States, with $50.3 billion (Ministry of Finance, 2005a, b).

[1]References that include a section mark (§) are found in the Internet References Cited section.

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Metals

Iron and Steel.—Taiwan was the fifth ranked crude steel producer in Asia behind China, Japan, the Republic of Korea, and India. China Steel Corp. (CSC) was the leading steel producer and the only pig iron producer in Taiwan. Without any coal and iron ore resources on the island, CSC depended on imports of coal and iron ore to meet its demand. Each year, CSC imported about 8.6 million metric tons (Mt) of coking coal and 16 Mt of iron ore mainly from Australia, Brazil, Canada, India, Indonesia, Russia, and Vietnam. The increased price of iron ore affected CSC's profit margin. Even though CSC had signed long-term supply contracts with overseas suppliers, the company was considering investment opportunities in iron ore and coal mines in other countries. Taiwan produced less than 20 Mt of crude steel and consumed more than 26 Mt of crude steel. The supply and demand gap was met by imports, mainly from China, Japan, and Russia. Taiwan also imported about 4 million metric tons per year (Mt/yr) of steel scrap from Japan, Russia, and the United States (Steel Statistics Monthly, 2006c; China Steel Corp., 2006§).

CSC relined its No. 2 blast furnace and expanded the inner volume of the furnace by 15% to between 3,300 and 3,400 cubic meters from 2,850 cubic meters in 2005. After the expansion, pig iron production was expected to increase by 350,000 metric tons per year (t/yr). In 2005, owing to a temporary shutdown of the No. 2 blast furnace, pig iron output was lower than in the previous year. CSC planned to invest $6.7 billion during the next 6 years to develop its core-business operations. CSC's subsidiary, Dragon Steel Corp., in which CSC and its affiliates combined held a 70% interest, planned to invest $2.43 billion to build an integrated iron and steel plant in Taichung. The integrated plant was designed to have a 3,274-cubic-meter blast furnace with an annual output capacity of 2.5 Mt, a sintering plant with a production capacity of 7,440 metric tons per day of sinter, and a 2-strand slab caster that could produce 2.6-Mt/yr of slab that is between 950 and 1,680 millimeters (mm) wide and 250 mm thick. Dragon awarded Siemens Group of Germany the contract to supply the equipment. Dragon also planned to invest $609 million to set up a 4-Mt/yr hot-rolling line. The blast furnace operation was scheduled to start in 2009. The design of the second blast furnace was under consideration. Dragon planned to have a total crude steel output capacity of 6 Mt/yr (Steel Statistics Monthly, 2006a, b).

The Executive Yuan approved Formosa Plastics Group's (FPG) request to build an integrated iron and steel plant at the Yunlin Offshore Industrial Zone in Yunlin County. The construction cost for the 7.5-Mt/yr steel plant was estimated to be $4.3 billion. The environmental impact assessment study was submitted to Taiwan Environmental Protection Administration (EPA), which required FPG to provide more detailed information on how the plant could affect local residents because the effect of emissions of carbon dioxide and other greenhouse gases was not addressed adequately in the environmental impact assessment study. The new plant was scheduled to begin operation in 2009 (Taiwan Journal, 2006§).

In 2002, MOEA and the debt-ridden state-owned steel company Tang Eng Iron Works Co., which was the oldest stainless steel plant in Taiwan, agreed to sell off Tang Eng's nonprofitable divisions and allow the profitable stainless steel plant to stay in operation. The Legislative Yuan approved Tang Eng's privatization plan and allowed employees to purchase the company's stocks in 2005. Tang Eng planned to invest $200 million to build a 600,000-t/yr hot-rolled stainless steel plant and to increase the crude stainless steel output capacity to 350,000 t/yr from 200,000 t/yr in 2005. Tang Eng shipped its crude stainless steel ingot to CSC for further processing into hot-rolled and cold-rolled products (United News, 2006§).

Industrial Minerals

Cement.—Owing to an increased demand for construction materials globally in 2005, the production of cement in Taiwan increased slightly. Domestic demand for cement gradually decreased to 14.7 Mt in 2005 from 27.9 Mt in 1993. Exports of cement increased by 22.5% to 7.03 Mt in 2005 compared with that of 2004. Cement was shipped mainly to, in descending order of amount shipped, Nigeria, the United States, Singapore, and Hong Kong. Owing to a lack of limestone resources and a limited market on the island, Taiwan cement producers gradually moved their production base to China in the late 1990s and expanded their cement output capacities there. Taiwan's second ranked cement producer, Asia Cement Corp., was building three cement plants in China—Hubei Yadong Cement Co. in Hubei Province, Jiangxi Yadong Cement Co. in Jiangxi Province, and Sichuan Yadong Cement Co. in Sichuan Province. Asia Cement planned to expand its cement operations in China in the near future because of the increased demand for cement in the construction sector in China. The production of Hubei Yadong was expected to increase cement output capacity to 1.6 Mt/yr in 2007. Wuhan Yadong Cement Co. increased its output capacity to 1.6 Mt/yr in 2005. The third stage expansion of Jiangxi Yadong was scheduled to be completed in May 2007, and total cement output capacity was expected to increase to 6 Mt/yr. Sichuan Yadong planned to build two kilns with a total cement output capacity of 4 Mt/yr. The first kiln was expected to be put into operation by September 2006 (Asia Cement Corp., 2006, p. 7).

Taiwan Cement Corp.'s (TCC) mainland China cement project was positioned to take advantage of the market in southern China and to be a highend cement producer. TCC's investment strategy in China was to make direct investments and to form joint ventures with local cement producers. TCC and Conch Cement Group of mainland China set up a joint-venture cement plant in Xuzhou, Jiangsu Province. TCC had two wholly owned grinding plants in Fuzhou, Fujian Province, and Juchiachiao, Anhui Province. TCC completed the construction of a 4.5-Mt/yr cement plant in Yungde, Guangdong Province, in 2005 and planned to expand the output capacity to 9 Mt/yr by 2008. During the past several years, the company invested $100 million in mainland China, and the output capacity of its plants was expected to reach 10 Mt by yearend 2006. TCC planned to invest $300 million to expand capacities at its existing cement plants and to build a new plant in Kueigang, Guangxi Province.

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The company's total cement output capacity in mainland China was expected to reach 20 Mt/yr in 2008. Demand for high-grade cement in southern China was 120 Mt; local cement producers could supply from about 20% to 30% of that demand (Taiwan Economic News, 2005§).

Mineral Fuels

Coal.—Without any coal production, Taiwan depended on imported coal to meet its demand. In 2005, Taiwan imported a total of 60.4 Mt of coal; of this total, Australia provided 22.43 Mt; Indonesia, 19.49 Mt; and China, 16.18 Mt. Power generation accounted for 77.05% of total coal consumption. Because its No. 2 blast furnace was shut down, coal consumption by CSC was lower, and accounted for 9.75% of total consumption, or 5.89 Mt. Taiwan Power Co. (Taipower) was the leading coal consumer on the island and imported about 52% of Taiwan's coal imports. To reduce shipping costs, imports of coal from South Africa and the United States had been decreased sharply in the past 2 years (Taiwan Energy Statistical Hand Book 2005, 2006, p. 49).

Natural Gas and Petroleum.—With limited mineral fuel resources, Taiwan produced only about 1.9% of its natural gas and petroleum requirements and relied on imports—mainly through long-term contracts with Indonesia and Malaysia—to fill the gap. Natural gas consumption grew by an average of more than 10% during the past decade and accounted for 10.2% of the island's total energy consumption. Increased use of natural gas [including liquefied natural gas (LNG)] in power generation was the primary source of the growth. In 2005, state-owned Chinese Petroleum Corp. (CPC), which was the sole LNG importing company, imported 9.37 billion cubic meters of LNG. Because Taiwan's LNG consumption was expected to continue to increase, domestic energy analysts projected that LNG imports would increase by an average of 7.9% in the next 15 years (Bureau of Energy, 2006§).

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TABLE 1

TAIWAN: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2001	2002	2003	2004	2005
METALS						
Gold, primary	kilograms	2	--	--	--	--
Iron and steel, metal:						
Pig iron	thousand metric tons	10,316	10,524	10,779	10,938 r	9,854
Ferrosilicon		1,181	--	--	--	--
Steel, crude	thousand metric tons	17,336	18,255	18,832	19,604	18,567
Nickel, refined e		11,000	11,000	11,000	11,000	11,000
INDUSTRIAL MINERALS						
Cement, hydraulic	thousand metric tons	18,128	19,363	18,474	19,050	19,891
Feldspar		147	--	510	900	--
Fire clay		5,641	2,083	7,546	3,686	330
Gypsum, precipitated		1,006	--	--	--	--
Lime		457,811 r	503,567 r	519,782 r	493,733 r	443,879
Mica		9,733	6,595	3,237	2,973	8,608
Nitrogen, liquid		539,532	538,338	534,721	650,359	794,933
Salt, marine		66,150	56,720	191	--	--
Sodium compounds, n.e.s.:						
Caustic soda		466,630	508,760	568,180	570,000 e	570,000 e
Soda ash e		140,000	140,000	140,000	140,000	140,000
Stone:						
Dolomite	thousand metric tons	71	55	54	115	174
Limestone	do.	4,901	3,677	1,434	213	252
Marble	do.	20,475	23,736	21,041	22,970	24,070
Serpentine	do.	276	268	194	229	408
Sulfur		223,659	212,343	225,006	222,670	267,790
Talc		130	27	466	410	--
MINERAL FUELS AND RELATED MATERIALS						
Gas, natural:						
Gross	million cubic meters	849	887	831	796	548
Marketed e	do.	780	785	760	720	490
Petroleum:						
Crude	thousand 42-gallon barrels	279	321	288	280	203
Refinery products e	do.	250,000	260,000	270,000	280,000	285,000

e Estimated; estimated data are rounded to no more than three significant digits. r Revised. -- Zero.

[1] Table includes data available through September 20, 2006.

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TABLE 2
TAIWAN: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies	Location of main facilitites	Annual capacity[e]
Cement		Asia Cement Corp.	Hsinchu	1,800
Do.		do.	Hualien	4,020
Do.		Chia Hsin Cement Corp.	Kaohsiung	1,860
Do.		Chien Tai Cement Co. Ltd.	do.	1,720
Do.		Lucky Cement Corp.	Tungao	2,000
Do.		Southeast Cement Corp.	Kaohsiung	1,090
Do.		do.	Chutung	1,400
Do.		Taiwan Cement Corp.	Hualien City	1,600
Do.		do.	Hualian County	5,600
Do.		do.	Suao	3,400
Do.		Universal Cement Corp.	Kaohsiung	1,550
Marble		Taiwan Marble Co., Ltd.	Panchiao	10
Nickel		Taiwan Nickel Refinery	Kaohsiung	14
Petroleum:				
Crude	thousand 42-gallon barrels per year	Chinese Petroleum Corp.	Chuhuangkeng and Tungtzuchiao	850
Refinery products	thousand 42-gallon barrels per day	do.	Kaohsiung	570
Do.	do.	do.	Taoyuan	200
Do.	do.	Formosa Plastics Group	Yunlin	450
Steel		An Feng Steel Co. Ltd.	Kaohsiung Hsien	2,000
Do.		China Steel Corp.	Kaohsiung	13,000
Do.		Tang Eng Stainless Steel Plant	do.	200
Do.		Yieh Hsing Enterprise Co. Ltd.	Kaohsiung Hsien	450
Do.		Yieh Phui Enterprise Co. Ltd.	do.	1,300
Do.		Yieh United Steel Co.	do.	1,000
Do.		Feng Hsin Iron and Steel Co. Ltd.	Taichung Hsien	1,200
Sulfur		China Petrochemical Development Corp.	Taipei	50

[e]Estimated.

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THE MINERAL INDUSTRY OF THAILAND

By John C. Wu

Thailand, which is located north of the Andaman Sea and the Gulf of Thailand, east of Burma, west of Cambodia and Laos, and north of Malaysia in Southeast Asia, was classified as a lower-middle-income developing country by the World Bank. The country had a population of about 65.6 million. Its total area is about 514,000 square kilometers (km^2). In 2005, Thailand's gross domestic product (GDP) and per capita GDP based on purchasing power parity were estimated to be $544.8 billion and $8,319, respectively (International Monetary Fund, 2006§[1]; U.S. Central Intelligence Agency, 2006§; World Bank, 2006§).

Thailand's identified mineral resources are antimony, ball clay, barite, bentonite, copper, diatomite, dolomite, feldspar, fluorite, gold, gypsum, iron ore, kaolin, lead, limestone, manganese, marl, phosphate rock, potash, quartz, rock salt, silica sand, tin, tungsten, and zinc (Department of Mineral Resources, 1998, p. 18). Thailand also has small resources of coal, natural gas, and crude petroleum.

Resources of such industrial minerals as diatomite, dolomite, gypsum, kaolin, limestone, marl, potash, and silica sand were more abundant than other identified minerals. The resources of barite, copper, fluorite, gold, gypsum, iron ore, lead, quartz, potash, tin, tungsten, and zinc, however, have higher unit value. During the past 20 years, most of the identified minerals except potash have been exploited for domestic consumption and export.

In terms of value, limestone, coal (lignite), gypsum, gold, and zinc were the five most important minerals produced in 2005. Thailand was one of the world's top producers of feldspar and gypsum and one of the world's leading exporters of cement, feldspar, and gypsum. Cement, coal (lignite), dolomite, feldspar, natural gas, gold, gypsum, limestone, crude petroleum, rock salt, silica sand, tin, and zinc were important to the Thai economy. Some of these minerals, which included cement, feldspar, gold, limestone, rock salt, refined tin, and zinc, were exported to earn foreign currency. The leading export mineral commodities in 2005 were cement, gypsum, refined petroleum products, and refined tin and zinc.

According to the National Economic and Social Development Board, the output of the mining and quarrying sector, which accounted for 2.3% of the country's real GDP in 2005, grew by 9.5% compared with 4.7% in 2004. The Thai economy as measured by the real GDP in 1988 constant dollars grew by 4.5% compared with 6.2% in 2004. The Thai GDP in 1988 constant dollars was estimated to be $95.4 billion[2] compared with $91.3 billion in 2004. The inflation rate as measured by change in the Consumer Price Index rose to 4.5% in 2005 from 2.7% in 2004. In 2005, Thailand had a merchandise trade deficit of $8.6 billion compared with a trade surplus of $1.5 billion in 2004; the deficit was the result of a 26% surge in imports, which resulted from a 56.7% increase in imports of crude petroleum and refined petroleum products to $18.8 billion accompanied by an increase in exports of only 15%. The country's total outstanding debt increased slightly to $52.0 billion in 2005 from $51.3 billion in 2004 (Bank of Thailand, 2006b§).

Government Policies and Programs

Thailand's mineral resources are owned by the state. Mineral exploration and development are governed by the Minerals Royalty Act No. 4 of 1966, the Minerals Act of 1967, and the Tin Control Act of 1977. The Minerals Act of 1967, which had been amended in 1973, 1979, and 1991, was amended again by Minerals Act No. 5 in 2002 for underground mining; the new amendment permits mining at depths of greater than 100 meters (m) below the surface without the need to obtain the specific consent of the holder of the surface right. The Minerals Act governs onshore and offshore exploration, mineral production, mineral trade, ore dressing, transport, and export of minerals other than petroleum. The Minerals Royalty Act prescribes the rates of royalties to be assessed for different kinds of minerals. The Tin Control Act controls tin mining and trade.

Under the Minerals Act of 1967, the Ministry of Industry was appointed as the principal Government agency to govern the mining sector. The Department of Primary Industry and Mines (DPI&M) is empowered to administer the Minerals Act and to issue ministerial regulations and provides technical assistance in mining, mineral processing, and metallurgical activities under the jurisdiction of the Ministry of Industry. The Department of Mineral Resources (DMR) is empowered to draft national mineral and geologic policies and provides technical assistance in geologic prospecting and mineral exploration under the jurisdiction of the Ministry of Natural Resources and Environment (Department of Mineral Resources, 2004§).

Environmental Issues

The Klity mining case, which was an ongoing case involving environmental pollution related to lead mining, was still not yet resolved fully in 2005. The village of Klity in Kanchanaburi Province, which is located 109 kilometers (km) west of Bangkok, had long suffered from lead poisoning related to lead sediment and contamination in the Klity Creek near the village. A lead mine, which was operated by Lead Concentrate Thailand Company, discharged waste into the creek. The villagers who drank water collected from this creek suffered from some form of lead poisoning. An independent advocacy group called Environmental Law for the Wants (ENLAW) brought a civil suit against the lead mining company in 2000 to clean up the pollution and offer victim restitution. According to New York-based Blacksmith Institute, ENLAW also brought an administrative suit against the Government's Pollution Control Department (PCD) for its failure to implement its own

[1]References that include a section mark (§) are found in the Internet References Cited section.

[2]Value has been converted from Thai Baht (B) to U.S. dollars (US$) at a rate of B40.27=US$1.00 for 2004 and 2005.

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plan to restore the quality of lead-contaminated Klity Creek. The PCD reportedly had installed an irrigation apparatus along the contaminated creek to capture the lead sediment, but this had created a sludge problem. In 2005, ENLAW reportedly was considering a case against the Basic Industry Department under the Ministry of Industry to restore the environment in and around the lead concentrator (Blacksmith Institute, The, 2005§).

A research study on the cadmium contamination problem in the vicinity of Mae Tao Creek in Mae Sot district in Tak Province, which was commissioned by Padaeng Industry Public Company Ltd. (PDI) in 2004 and conducted by the National Research Center for Environment and Hazardous Waste Management at Chulaongkorn University, was completed in 2005. The study concluded that contamination in the Mae Tao Basin had emanated from natural sources and from human activities of all kinds that had aggravated the natural process; these included industry, deforestation, forestry firing, and human settlements. As a result, the Government banned farmers from growing edible crops in the cadmium-contaminated area. A task force made up of representatives of local villagers, community leaders, and officials of the public and private sectors was established to 1) prepare a plan to rehabilitate cadmium-contaminated areas, 2) control and prevent pollution, 3) promote economic development that emphasizes quality of life and health, and 4) make the Mae Tao management more efficient. To assist the task force, PDI was to provide such required information as geologic and geographical mapping and resources for sampling and analysis. PDI had donated medical equipment including a bone-quality detector, provided financial support for the nonedible-plant cultivation project, and established the Mae Tao Basin Community Development Fund for the benefit of the community around the mine (Padaeng Industry Public Company Ltd., 2006§).

Production

In 2005, Thailand's mineral production included antimony, barite, coal, diatomite, dolomite, feldspar, fluorspar, natural gas, gemstones, gold, gypsum, iron ore, kaolin, limestone, marble, manganese, crude petroleum, perlite, phosphate rock, quartz, salt, silica sand, silver, talc, tin, tungsten, and zinc. The main processed mineral products were cement, fluorite (metallurgical grade), refined petroleum products, steel, refined tin, and refined zinc. Thailand also produced tantalum metal powder and oxides, which were produced from tantalum-bearing scrap and tin slag purchased from domestic and foreign sources. Production of most minerals, which included metallic minerals, industrial minerals, and mineral fuels, increased in 2005. Production of most processed mineral products, such as cement, refined petroleum products, steel, and refined tin, also increased in 2005 (table 1). The higher level of mining activities in Thailand reflected the continued growth in the Thai economy and increased worldwide demand for materials in 2005.

Trade

In 2005, exports increased by 15% to $109.2 from $94.9 billion in 2004, and imports increased by 26% to $117.8 billion from $93.5 billion in 2004. Thailand's merchandise trade balance suffered from a deficit of $8.6 billion versus a surplus of $1.5 billion in 2004 (Bank of Thailand, 2006a§).

Thailand was a net importer of mineral commodities mainly because of its large import bills for coal, natural gas, crude petroleum, iron and steel products, and nonferrous metals. According to Thailand's Customs Department, exports of mineral products totaled $2,000.05 million in 2005, of which refined tin was valued at $191.14 million; gypsum, $70.07 million; and all other mineral products, $1,738.84 million. Exports of major processed mineral commodities were base-metal products, which included ferrous and nonferrous metal products, $4.5 billion; refined petroleum products, $3.4 billion; pearl, precious stones, and jewelry, $3.2 billion; ceramic products, $615.2 million; and cement, $462.7 million (Bank of Thailand, 2006a§).

In 2005, imports of major mineral fuel commodities were as follows: crude petroleum, $16.9 billion; refined petroleum products, $1.9 billion; natural gas, $1.5 billion; and coal, $542.4 million. Imports of major nonfuel mineral products were as follows: iron and steel products, $8.5 billion; metal and metal products, $5.9 billion; minerals and mineral products, $2.4 billion; nonmonetary gold (gold ingot), $2.0 billion; jewelry and silver bar, $1.9 billion; fertilizers and pesticides, $1.2 billion; and cement and construction materials, $212.5 million (Bank of Thailand, 2006a§).

Commodity Review

Metals

Antimony.—Mine and metal production of antimony rose sharply in 2005. According to DPI&M, two metal producers—New Siam Mineral Resources Co. Ltd. and Peak Union Co., which stopped production in 2004—resumed their operations in the first half of 2005. The two companies reportedly imported raw materials from China because of insufficient supply from domestic sources despite a substantial increase in the 2005 mine production. Antimony metal production was sold mostly to domestic battery producers. Exports of antimony metal were mainly to the Asia and Western Europe markets (Metals Place, 2005d§).

Copper.—In June 2005, Pan Australian Resources Ltd. (PAR) of Australia through PNA (Puthep) Pty Ltd. (PNA), which is a wholly owned subsidiary of PAR, received a 20.66% share allocation in the Puthep Company Ltd. (Puthep) in accordance with the participating agreement dated August 21, 2000. The company and its joint-venture partner PDI agreed to the suspension of PNA's expenditure obligations under the agreement until Puthep and/or the DPI&M receives the land permit for the research program on the PUT1 deposit area from the Department of Forestry. PAR has the right to earn a 51% interest in the Puthep copper project, which is located about 20 km southeast of Loei in northern Thailand, through PNA by providing a minimum of $4 million for a bankable feasibility study. PAR has options to acquire a total of 60% or 70% interest in Puthep, and the Government of Thailand retains a right to acquire a 10% interest in Puthep after it approves plans to develop a mine (Pan Australian Resources Ltd., 2006§).

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Thai Copper Industries Plc, which operated a copper smelter and refinery in Rayong Province in eastern Thailand, began operations on September 24, 2004, with an initial capacity of 72,000 metric tons per year (t/yr) of copper cathode. In 2005, the company's copper smelter reportedly produced 62,300 metric tons (t) of blister and anode compared with 19,600 t in 2004, and its copper refinery produced about 30,000 t of copper cathode compared with 20,000 t in 2004. To meet domestic demand for refined copper, Thailand imported 235,900 t of refined copper in 2005 compared with 223,900 t in 2004. Consumption of refined copper totaled 257,000 t in 2005 compared with 240,000 t in 2004 (International Copper Study Group, 2006, p. 14, 16, 19, 29).

According to an official of Thai Copper Industries, the 2005 production of refined copper had been interrupted by technical problems that caused the plant to shut down twice during the first quarter of 2005. With all the major problems solved by the end of 2005, the company was expecting to increase production by 20,000 t in 2006 (Metals Place, 2005a§).

Gold.—Amanta Resources Ltd. of Canada, which obtained two special prospecting licenses (SPL) for the Langu gold property in Satun Province, southern Thailand, in August 2004, commenced its exploration program in March 2005. The Langu gold project covers a 25-km^2 area that surrounds an outcropping mineralized area with high-grade replacement style sediment-hosted gold in Devonian limestone and shale. Rock samples taken from outcropping decalcified limestone of the Discovery quarry returned assayed values that range from 4.15 grams per metric ton (g/t) to 36.8 g/t gold; samples from abandoned quarried stockpile material had values as high as 153.5 g/t gold. After an extensive 6-month field investigation program, Amanta Resources completed its initial exploration program in September 2005 and believed that the extensive surface findings, especially the large lateral extents of the anomalous ground, the high gold grades in the rock, and the widespread silica alteration, hold substantial promise for significant resource potential. In September 2005, Amanta Resources submitted two additional SPL applications for an area that is contiguous to the present (2005) 25-km^2 exploration area and covers an additional 32 km^2 (Amanta Resources Ltd., 2004a; 2005a§-c§).

Tongkah Harbour Plc, through its 96% owned subsidiary Tungkum Ltd., had been exploring for gold at its Block 4 concession in Loei Province in northeastern Thailand since the late 1990s. Six applications of the first batch had been approved by the Government in January 2003. The mining licenses were valid for a 25-year period. Gold resources had been estimated to be 4.49 million metric tons (Mt) at a grade of 4.14 g/t gold (Tongkah Harbour Plc, 2005a§).

As of December 2005, according to the company's activities update for its Loei gold project, all infrastructure and earth works were mostly completed; mine site development, facilities construction, and processing equipment installation were in progress and expected to be completed on schedule before the end of 2005. The company planned to start commercial gold production in the first quarter of 2006. Under the company's mining plan, about 1.5 Mt of ore would be mined from the Loei gold project to produce about 5.6 t of gold during a 4-year period.

Tongkah Harbour held a 98.86% equity interest in Tungkum Ltd., which had 100% control of the mineral concession for exploration and mining of gold and related minerals in Loei Province (Metals Place, 2005c§; Tongkah Harbour Plc, 2005b§).

Kingsgate Consolidated N.L. of Australia, through its 90% owned subsidiary Akara Mining Ltd., produced gold from the Chatree Mine, which is located 45 km southeast of the provincial capital of Phichit on the border of Petchabun and Phichit Provinces. Production of gold from the Chatree Mine decreased slightly to 4,400 kilograms (kg) (142,000 troy ounces) in 2005 from 4,500 kg in 2004. Production of silver from the Chatree Mine was about 14,300 kg (459,701 troy ounces). The average ore grade was about 2.7 g/t gold and the recovery rate averaged about 90% in 2005 (Kingsgate Consolidated Ltd., 2005a§).

To upgrade the processing plant, Kingsgate completed installation and the commissioning of Stage 1 of the pebble/scats crusher, increased the throughput to 2.1 million metric tons per year (Mt/yr), and scheduled complete installation of Stage 2 by the end of 2005 to raise the processing capacity to 2.35 Mt/yr. In 2005, Kingsgate started a feasibility study to expand the plant's milling capacity to 5 Mt/yr. The study was scheduled to be completed in 2006 (Kingsgate Consolidated Ltd., 2005b§).

In July 2005, a significant new mineralization zone was discovered 200 m east of the existing A East mineral resource in the Chatree North area. The most significant results included 12 m at a grade of 30.0 g/t gold and 318 g/t silver. In December 2005, an in-pit resources development drilling program at Chatree also identified significant high-grade mineralization and renewal of the C South lode beneath the main open pit. According to Kingsgate Consolidated, results from the latest campaign included 17 m at a grade of 7.36 g/t gold from 72 m below the current pit surface and 9 m at a grade of 7.54 g/t gold from 54 m below the current pit surface. New gold zones were located immediately west of pit H and north of pit C. Ore reserves at Chatree and Chatree North increased by 25% to 57,230 kg (1.84 million troy ounces) and 526,318 kg (16.6 million ounces) (Kingsgate Consolidated Ltd., 2005c§).

Iron Ore and Iron and Steel.—Mine production of iron ore was up by 62% to 219,896 t in 2005. To meet the iron and steel industry's raw material requirements, Thailand relied heavily on imports of ferroalloys, pig iron, and steel scrap.

Thailand's crude steel production was up by 14% to 5.2 Mt in 2005 from 4.53 Mt in 2004 (Southeast Asia Iron and Steel Institute, 2006§). Thailand's crude steel was produced by electric arc furnaces, which used mostly imported iron and steel scrap. According to a forecast by the Federation of Thai Industries, steel demand was to grow by 15% in 2005 from 12.6 Mt in 2004. Demand for steel grew by 16% in 2004 and by 9% in 2003. The estimated strong growth during the next 6 years would be driven by the country's large infrastructure construction projects; the estimated annual average growth rate of Thai steel demand between 2007 and 2010 was forecasted to be 10% and then to grow at a slower average rate of 6% from 2011 to 2020 (Southeast Asia Iron and Steel Institute, 2005c§).

In early 2005, the Thai Cabinet reportedly had signaled its willingness to support the major upstream steel mill projects by agreeing to finance the development of basic infrastructure

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requirements for such projects, which had been planned by G-Steel Plc and the Sahaviriya Group Corp. Ltd. G-Steel, which operated three 130-t electric arc furnaces with the capacity of 1.8 Mt/yr, planned to build a blast furnace steel plant with an additional capacity of 2.65 Mt/yr near its existing mill in Rayong on Thailand's eastern seaboard. Sahaviriya Group announced in 2004 that it would launch a five-phase integrated steel project with a 30 Mt/yr capacity during a 15-year period in Bang Saphan district, Prachuap Khiri Khan Province, in southern Thailand. Although the Board of Investment had already approved the two iron smelting projects in 2005, the status of these projects remained vague because both G-Steel and Sahaviriya Group reportedly had not yet decided what type of equipment to install, who would supply the equipment, and who would install the equipment (Southeast Asia Iron and Steel Institute, 2005b§).

In March 2005, Millennium Steel Public Co. Ltd. reportedly completed a project to expand and upgrade the capacity of NTS Steel's billet plant in Sriacha, Chon Buri Province to 500,000 t/yr from 280,000 t/yr. Millennium Steel was a new holding company that had been formed by the merger of Cementhai Steel and NTS Steel Group Public Co. Ltd. in July 2002. Millennium Steel, which had a rated melting capacity of 1.2 Mt/yr, imported about 100,000 t/yr of billet to supplement its operating capacity of 800,000 t/yr. Millennium Steel had the capacity to produce 1.7 Mt/yr of construction long-steel products, which included 900,000 t/yr of rebar, 630,000 t/yr of wire rod, and 170,000 t/yr of small section and other steel bars. In 2005, the company planned to increase its output of long-steel products to 1.15 Mt/yr. The 250,000 t/yr increase in long-steel products would comprise high-quality wire rod in high-carbon, medium-carbon, and low-carbon grades. Millennium Steel distributed most of its products to the domestic market and exported about 3% of its output to such neighboring countries as Indonesia, the Philippines, and Vietnam (Southeast Asia Iron and Steel Institute, 2005a§).

In September, Shougan (Capital Steel) Corp. of China reportedly planned to invest about $2.5 billion to build an integrated steel plant in Thailand to supply the Thai domestic market and for export to Association of Southeast Asian Nations (ASEAN) countries. According to the Ministry of Industry, the proposed integrated steel plant would have a capacity to produce from 3 Mt/yr to 4 Mt/yr of a wide range of steel products, which would include hot-metal, slab, and rolled products for Thailand's domestic consumption and for export to ASEAN countries (Metals Place, 2005b§).

In December, Tata Steel Ltd., which was India's second ranked steel producer, agreed to buy a 40% equity interest in Millennium Steel Plc for about $74 million. Tata Steel would acquire Siam Cement Public Company Ltd.'s stake in Millennium and was offering to buy the remaining shares at a total cost of about $175 million. Tata Steel planned to triple its production to 15 Mt/yr by 2010 by expanding its capacity in India and acquiring steel companies overseas (Bloomberg.com, 2005§).

Tin.—Mine production of tin dropped sharply from 724 t of tin concentrate in 2004 to a new historical low of less than 190 t of tin concentrate in 2005. To meet its tin smelter's feedstock requirement, Thailand imported more than 20,000 t of tin concentrate in 2005 compared with about 12,800 t in 2004 (World Bureau of Metal Statistics, 2006, p. 127). Tongkah Harbour, which was one of Thailand's major tin producers in 2004, had temporarily stopped tin mining operations at the Bangtao Bay, the Pang-Nga, and the Phuket Bay areas since April 2005 owing to the high royalty rate on tin. According to Tongkah Harbour, the company was negotiating with the DPI&M to review the royalty rate and to adopt a more competitive rate. During 2005, Tongkah Harbour increased its equity-interest holdings in Sea Minerals Ltd., which was one of Tongkah Harbour's subsidiaries engaged in offshore tin mining, to 83.7% for tin mining prospects farther offshore. Sea Minerals reportedly controlled extensive offshore tin resources, which were estimated to be more than 50,000 t of tin. Sea Minerals had completed the technical feasibility study of mining the deposit and was expected to complete the financial feasibility study by the end of 2006 (Mining Journal, 2006; Metals Place, 2006§).

Tearlach Resources Limited of Vancouver, British Columbia, Canada, had negotiated a joint venture with Asian Tiger Resources Limited of Toronto, Ontario, Canada, in early 2004 for a tin tailing recovery project that is located in the tin-rich mountainous region near the Myanmar border in central Thailand about 125 km northwest of Bangkok. The companies commenced a drilling program that involved about 35 holes to evaluate the prior drill program and to collect a representative sample for metallurgical testing. The project was designed to evaluate the economic recovery of tin and other industrial minerals from about 17 Mt of mineralized sands that remained after initial recovery of tin from alluvial deposits mined between 1978 and 1985. The prior drilling suggested that a suite of heavy and light minerals not previously recovered, such as garnet, muscovite mica, rare earths, tantalite, and tin, were present in sufficient quantities to justify a metallurgical review for recovery and extraction cost analysis (Tearlach Resources Ltd., 2005§).

According to the DPI&M, metal production of refined tin increased by 52% to 31,600 t in 2005 from 20,800 t in 2004. According to Thailand Smelting and Refining Co. Ltd. (Thaisarco), the higher tin metal production was a direct result of increased feedstock (tin concentrate) imported from overseas. Thaisarco had operated below its 36,000-t/yr capacity in the past few years because of limited or tight supply of tin concentrate. Thaisarco produced regular refined tin metals, Thaisarco brand tin that contained 99.85% tin and low-lead tin metals with 50 or 100 parts per million lead, tin-lead, and lead-free solders; tin alloys; pewters; and tin powders (Metals Place, 2006§; Thailand Smelting and Refining Co. Ltd., 2006§).

Domestic demand for refined tin totaled about 4,600 t in 2005 compared with 5,900 t in 2004. Thailand refined tin exports went mainly to the Netherlands (61%), Japan (14%), and Belgium (8%) in 2005 (World Bureau of Metal Statistics, 2006, p. 127).

Tungsten.—Amanta Resources Ltd. of Canada had signed a memorandum of understanding (MOU) with Amanta Ltd. of Thailand to acquire exploration and development rights to multiple minerals [fluorite, stibnite (antimony ore), and tungsten] property in Phrae Province in northern Thailand in August 2004. In August 2005, the company announced that

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it had successfully completed a systematic surface sampling and mapping program of an area that covered 1.25 km^2 of the Doi Ngom breccia pipe with total dimensions of about 2.5 km by 0.5 km. The company said that a large tungsten anomaly that covers an area of 500 m by 800 m was identified and that the anomaly's main concentration of high-grade mineralized materials occurs along the north-south trending silicified ridge. Amanta Resources planned to initiate a drilling program in September 2005 (Amanta Resources Ltd., 2004b; 2005d§).

Zinc.—Mine production of zinc increased by 42% to the highest level since 1995. Zinc silicate ore produced from the Mae Sot Mine increased by 4.8% to 175,000 t from 167,024 t in 2004. The average metal content of zinc silicate ore produced in 2005 was 27% zinc compared with 26% zinc in 2004. According to PDI, as of December 31, 2005, the remaining mineral resource at the Mae Sot Mine totaled about 3.86 Mt at a grade of 12.3% zinc, of which 1.45 Mt at a grade of 13.1% zinc was measured resource; 1.64 Mt at a grade of 12.8% zinc, indicated resource; and 0.34 Mt at a grade of 13.0% zinc, inferred resource. Additionally, about 440,000 t of mined low-grade ore at a grade of 7% zinc was stockpiled at the mine site. During 2005, no new exploration had been conducted within the existing pit. The company planned to conduct exploration drilling in 2006 to reassess ore reserves of the existing five mining leases in the Mae Sot area (Padaeng Industry Public Company Ltd., 2006§).

In 2005, PDI's zinc smelter in Tak received 197,276 t of zinc concentrate that contained 51,012 t of zinc metal from the Mae Sot Mine. In addition, PDI imported a total of 92,781 t of zinc concentrate (zinc sulfide) from Australia and South America. The imported zinc sulfide concentrate was delivered to the roaster in Rayong (Padaeng Industry Public Company Ltd., 2006§).

In 2005, PDI's zinc refinery in Tak produced 99,708 t of cathode zinc, which was equivalent to about 88% of its capacity of 113,200 t/yr. The company imported 7,044 t of zinc ingot in 2005 for the production of valued-added zinc alloys. In 2005, the production of zinc metal products decreased by 12% to 101,186 t, of which 60,866 t was special high grade (SPG) zinc of 99.995% purity, and 40,320 t, zinc alloys (Padaeng Industry Public Company Ltd., 2006§).

Industrial Minerals

Cement.—In 2005, cement production increased by 6.3% to about 38 Mt and clinker production increased by 10.8% to about 39 Mt in 2005. This growth was largely the result of a 7% overall growth in the construction sector, which was stimulated mainly by an increase in office building and plant construction projects and ongoing infrastructural projects. Some of the growth momentum was lost in residential housing projects after tax incentives for homebuyers expired in 2004. As a result, domestic demand for cement by the construction industry slowed in 2005 because of the saturated housing market; building and factory investment projects, however, continued to grow in 2005 (Bangkok Post, 2005§).

According to Kasikorn Research Center (K Research), which was a subsidiary of the Kasikorn Bank Group of Thailand, domestic demand for cement was forecasted to increase by 9.2% to 29.7 Mt in 2005 from 27.2 Mt, compared with the growth of 12.2% in 2004. K Research projected that the Thai cement industry would rely on public investment projects in 2006, especially on the building of megaprojects, including roads, subways, and a water treatment system. Exports of cement were expected to reach more than 15 Mt valued at more than $460 million in 2005 compared with 11.9 Mt valued at $312 million in 2004. K Research forecasted that the domestic demand for cement in 2006 would grow by 15% to 34 Mt. If the Government's ambitious megaprojects, such as mass transit electrical train systems, are delayed, however, then the public sector's investment in construction may be reduced. As a result, the domestic demand for cement in 2006 would increase by only about 10% to 32.7 Mt and cement production would increase to between 42.4 and 43.6 Mt (Chinacement.com, 2005§).

Because of the slowdown in domestic cement sales during the second half of 2005, Siam Cement Industry Co. Ltd, which was Thailand's leading cement producer, forecasted that the building materials industry would be relatively unchanged in 2006 despite the continued growth in such sectors as low-cost housing. The company reported sales growth of about 10% in 2005 and expected its cement sales to grow by 3% to 6% in line with industry growth of up to 6% in 2006 (International Cement Review, 2006; Reuters Ltd., 2006§).

Siam City Cement Co. Ltd. in its 2005 annual report indicated that the company's operations were at full capacity after recommissioning of its plant 1 and that its sales were in line with growth of 7% in the domestic market. The company's export sales grew by more than 50% in 2005 (Siam City Cement Co. Ltd., 2005§).

Gemstones.—Thailand was one of the world's leading centers for gemstone cutting and heat treating. In the 1990s, Thailand produced ruby and sapphire mainly from the Bo Phloi area of Kanchanaburi Province, which borders Burma (Myanmar). In recent years, more blue, green, yellow, and star sapphire was produced from the Bang Kacha (Bangkraja) Mine in Chanthaburi Province in eastern Thailand bordering Cambodia. Many local gemstone dealers speculated that rich sapphire deposits were yet to be discovered in Chanthaburi Province. These deposits, however, are located in the military buffer zone along the border with Cambodia (Colored-stone.com, 2005§).

Potash.—In July 2005, Asia Pacific Resources Ltd. (APR) provided an update on the Udon South potash project. APR indicated that the development of the Udon South project remained APR's first priority and that exploration, engineering, and environmental activities for the project had all been completed. As of July 2005, the project was ready for financing and construction, subject to the grant of a mining license. By June 2005, DPI&M reportedly had completed the survey of the mine site boundaries. DPI&M, however, indicated that the plant site boundary also needed to be surveyed and that the survey results would be posted on the community notice boards. The Environmental Department (ED) had not completed the required review of the supplementary improvements to the Environmental Impact Assessment pending completion of the surveys. The ED had requested a notification from DPI&M of an approved mine plan. In 2005, APR continued its discussions

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with potential partners and financiers from China and Thailand. No agreements, however, had yet been reached (Asia Pacific Resources Ltd., 2005§).

The Udon South deposit was estimated to contain a potash resource of 302 Mt at a grade of 23.5% potassium oxide (K_2O). The measured and indicated resources totaled about 30 Mt at a grade of 26.8% K_2O within a high-value core area that averaged 7.2 m in thickness. APR's Udon North deposit, which was estimated to contain 700 Mt of potash resources, remained under exploration (Mining Journal, 2005).

Mineral Fuels

Coal.—Coal (lignite) production increased by 3% to 20.6 Mt in 2005 from 20.0 Mt in 2004. To meet the country's overall coal requirements, Thailand imported about 8.6 Mt of coal valued at about $383 million in 2005. Of those imports, bituminous steam coal accounted for 93.4% (8 Mt); anthracite, 5.7% (487,760 t); and coking coal, 0.8% (70,960 t) plus peat and briquettes (3,180 t) (Energy Policy and Planning Office, 2006a§).

In 2005, the state-owned Electricity Generating Authority of Thailand (EGAT) produced about 16.9 Mt of coal, of which more than 99% was produced from the Mae Moh Mines in the Province of Lampang (Electricity Generating Authority of Thailand, 2004§). The remaining 3.7 Mt of coal was produced by Banpu Mineral Co. Ltd. from the Lampang Mine (LP-2) in Lampang Province and the Chiang Muan Mine in Phayao Province and by Lanna Lignite Public Co. Ltd. from the Ban Pa Kha coal mines in Lamphun Province (Banpu Public Co. Ltd., 2005§; Lanna Lignite Public Co. Ltd., 2005§).

Consumption of domestically produced lignite totaled 21.1 Mt in 2005, of which 16.6 Mt was consumed by EGAT in power generation at the 2,625-megawatt Mae Moh lignite-fired powerplant and 4.5 Mt was consumed as energy by the manufacturers of cement, fiber, lime, and paper; by tobacco curers; and by other users. Imported coal (mostly anthracite, bituminous, and coking coal), which totaled 8.6 Mt, was consumed mainly by the manufacturers of cement, iron and steel, and nonferrous metals (Energy Policy and Planning Office, 2006a§).

Natural Gas and Petroleum.—Natural gas production increased by 6% to an average of 64.9 million cubic meters per day in 2005 from 61.2 million cubic meters per day in 2004 owing to increased output from the Funan/Jakrawan, the Pailin, and the Yala fields. In 2005, natural gas was produced from 19 gasfields, most of which were offshore. About 54.1% of Thailand's natural gas was produced by Unocal Thailand Ltd. (UT) from offshore gas and condensate fields (Baanpot; Erawan; Funan; Gomin; Jakarawan; Kaphong, which was brought onstream by UT in early 2004; Pailin; Platong; Satun; South Satun; and Trat); the remaining 45.8% was produced by PTT Exploration and Production (PTTEP) [a wholly owned subsidiary of the state-owned Petroleum Authority of Thailand (PTT)], ChevronTexaco Corp., and other companies from offshore gasfields (Benjamas, Bong Kot, Plamuk, Plandaeng, Surat Thani, Tantawan, and Yala) and onshore gasfields (Nam Phong and Sirikit) (Energy Policy and Planning Office, 2006b§).

In July, Amerada Hess Corp announced that an agreement had been signed with PTT for the sale of natural gas from the Phu Horm field, which is located onshore in the Province of Udon Thani in northeastern Thailand. The Phu Horm field was 35% owned and operated by Amerada Hess with APICO LLC (35%), PTT (20%), and Exxon Mobil Corp. (10%). According to the agreement, Amerada Hess is to supply more than 14.2 billion cubic meters of natural gas from the Phu Horm field for 15 years. The first gas was expected to be delivered to PTT's powerplant at Nam Phong in nearby Khon Kaen Province before the end of 2006 at an initial rate of about 2.27 million cubic meters per day, then gradually to increase to 2.84 million cubic meters per day (Amerada Hess Corp., 2005§).

PTTEP reportedly had jointly studied the feasibility of using the flare gas from Pratu Tao-A Oilfield for electricity generation with Ratchaburi Energy Company Ltd. The company had reached agreement with Ratchaburi Energy on supplying natural gas at the expected average rate of 11,327 cubic meters per day for 8 years beginning in the fourth quarter of 2006 (Rigzone.com, 2006§).

Production of crude petroleum increased by 33% to an average of 113,205 barrels per day (bbl/d) in 2005 from 85,750 bbl/d in 2004 as a result of a 48% increase in output from the Tantawan Oilfield, a 28% increase in output from the Bung YA&B oilfield, and a 27% increase in output from the Benjamas oilfied. In 2005, two new oilfields—Nangual and Jusmin—came onstream. In 2005, crude petroleum was produced from 12 oilfields. The largest onshore oilfield, the Sirikit oilfield, which was operated by Thai Shell Exploration and Production Co. Ltd., averaged 17,129 bbl/day and accounted for 15% of the total crude petroleum output in 2005. The largest offshore oilfield, the Benjamas oilfield, which was operated by Chevron Offshore Ltd., averaged 50,097 bbl/d and accounted for 44% (Energy Policy and Planning Office, 2006c§).

Production of condensate increased by 3% to an average of 70,342 bbl/d in 2005 from 68,575 bbl/d in 2004; this was mainly the result of increased output from the Gomin and the Pailin gasfields. In 2005, condensate was produced from 10 gasfields, of which about 30% of condensate was produced from the Pailin gasfield; 25%, from the Bongkot gasfield; 16%, from the Erawan gasfield; and the remaining 29%, from seven smaller fields (Energy Policy and Planning Office, 2006d§).

In June 2005, UT announced that it had successfully started up the second oil central processing platform (CPP) at the Platong operating area in the Gulf of Thailand. The Platong Oil CPP 2 was brought onstream safely and on schedule; it was expected to increase production significantly by the third quarter of 2005 to achieve the target of ramping up gross crude petroleum production to 40,000 bbl/d from about 24,000 bbl/d. The Platong Oil CPP2 was the largest CPP ever built in Thailand (Energy Business Review, 2005§).

Outlook

During the next 4 to 5 years, the Thai mineral sector is expected to expand and contribute more to the country's GDP because of the likely development of the Puthep copper deposit in the Province of Loei, the Udon South and the Udon

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North potash deposits in the Province of Udon Thani, and the development and expansion of new and existing offshore gasfields and oilfields in the Gulf of Thailand. During the next 2 years, the mineral industry of Thailand is expected to continue to be dominated by the production of coal, gold, gypsum, and limestone.

The International Monetary Fund projects that Thailand's GDP will grow at a rate of 5% in 2006 and 5.4% in 2007 (International Monetary Fund, 2006§). As a result, demand for cement, steel, nonferrous metals, and mineral fuels is expected to continue to grow in 2006 and 2007 at about the same rate as that of 2005.

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TABLE 1
THAILAND: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2001	2002	2003	2004	2005[p]
METALS						
Antimony:						
Ore:						
Gross weight		40	3	83	110	735
Sb content		18	1	38	52	330 [e]
Metal, smelter		12	--	--	2	460
Copper, metal, refined:						
Primary		--	--	--	18,100 [r]	28,000
Secondary		--	--	--	1,900	2,000
Total		--	--	--	20,000 [r]	30,000
Gold	kilograms	320	4,950	4,269	4,500	4,400
Iron and steel:						
Iron ore:						
Gross weight		50	570,110	9,675	135,580	219,896
Fe content[e]		25	285,000	4,800	68,000	110,300
Crude steel	thousand metric tons	2,127	2,538	3,572	4,533	5,161
Lead:						
Ore:						
Gross weight		800	6,500	--	--	--
Pb content		500	3,200	--	--	--
Metal, refined:						
Primary		-- [r]	-- [r]	-- [r]	-- [r]	--
Secondary		30,000 [r]	42,900 [r]	45,300 [r]	57,500 [r]	57,600
Total		30,000 [r]	42,900 [r]	45,300 [r]	57,500 [r]	57,600
Manganese ore:						
Battery- and chemical-grade, 75% MnO_2		45	--	--	--	--
Metallurgical-grade, 46% to 50% MnO_2		--	--	--	4,550	88,500
Total, gross weight		45	--	--	4,550	88,500
Mn content[e]		23	--	--	2,180	42,400
Silver	kilograms	1,159	18,018	12,496	10,700	14,300
Tantalum, metal and oxide powder		150	102	168	317	200 [e]
Tin:						
Concentrate:						
Gross weight		2,383	1,384	980	724	188
Sn content		1,950	1,130	793	586	206 [e]
Metal, primary		22,387	18,600 [r]	15,400	20,800	31,600
Tungsten concentrate:						
Gross weight		92	53	390	337	350 [e]
W content[e]		50	31	208	180	190
Zinc:						
Ore:						
Gross weight		88,664	151,876	148,297	199,477	283,810
Zn content[e]		15,300	33,600	37,100	43,400	42,570
Metal, primary		74,129	72,502	69,600	68,300	60,866
Alloy, Zn content		30,668	32,646	44,086	46,800	40,320
INDUSTRIAL MINERALS						
Barite		23,559	137,469	115,600	211,278	120,000 [e]
Cement, hydraulic	thousand metric tons	27,913	31,679	32,530	35,626	37,872
Clays:						
Ball clay		341,272	450,818	579,404	610,193	650,000 [e]
Kaolin, marketable:						
Beneficiated, washed		168,063	127,132	184,562	200,671	201,000 [e]
Nonbeneficiated, unwashed		125,133	168,883	373,811	430,364	400,000 [e]
Filler		13,520	3,150	950	--	--
Diatomite		720	780	1,288	1,372	1,400 [e]
Feldspar		710,543	783,733	824,990	1,001,053	1,000,000 [e]
Fluorspar, crude, metallurgical-grade		3,020	2,270	2,368	2,375	295
Gemstones	thousand carats	1,071	1,597	716	911	800 [e]
Gypsum	thousand metric tons	6,191	6,326	7,291	7,619	6,920

See footnotes at end of table.

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TABLE 1--Continued
THAILAND: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2001	2002	2003	2004	2005[p]
INDUSTRIAL MINERALS--Continued						
Mica		72	--	--	--	--
Perlite		9,915	7,600	5,700	6,000 [e]	5,500 [e]
Phosphate rock, crude		2,359	3,680	13,870	2,580	2,500 [e]
Salt:						
Rock		852,565	908,968	892,243	1,031,200	1,000,000 [e]
Other[e]		100,000	100,000	100,000	100,000	100,000
Sand, silica, glass		513,880	781,014	1,293,929	587,655	750,000 [e]
Stone:						
Calcite		159,050	172,760	232,025	436,628	440,000 [e]
Dolomite		871,308	933,209	865,708	992,907	950,000 [e]
Granite:						
Dimension stone	cubic meters	6,659	7,597	9,866	10,000 [e]	9,500 [e]
Industrial rock	thousand metric tons	2,546	3,370	3,107	3,500 [e]	3,000 [e]
Limestone:						
For cement manufacture only	do.	46,984	54,214	46,868	63,196	65,000 [e]
Construction and other uses	do.	40,100	56,226	66,073	70,000	75,000 [e]
Marble, dimension stone and fragment	cubic meters	314,445	461,272	339,166	236,643	250,000 [e]
Marl for cement manufacture only		7,755	83,135	80,405	184,750	185,000 [e]
Quartz		48,908	32,954	65,559	19,216	20,000 [e]
Shale for cement manufacture only	thousand metric tons	3,364	5,017	2,982	3,622	3,600 [e]
Talc and related materials:						
Pyrophyllite		59,602	103,496	73,556	108,691	105,000 [e]
Talc		6,838	1,702	8,501	12,592	13,000 [e]
MINERAL FUELS AND RELATED MATERIALS						
Coal, lignite	thousand metric tons	19,607	19,572	18,830 [r]	20,008 [r]	20,643
Natural gas, gross production	million cubic meters	19,611 [r]	20,451 [r]	21,677	22,330 [r]	23,690
Petroleum:						
Crude	thousand 42-gallon barrels	22,043 [r]	27,200 [r]	31,091 [r]	31,091 [r]	41,320
Natural gas condensate	do.	18,899 [r]	19,609	23,887 [r]	25,030	25,675
Refinery products:						
Liquefied petroleum gas	do.	37,067	37,069	38,872	41,520	45,241
Gasoline	do.	52,376	51,896	54,342	56,339	58,072
Jet fuel	do.	26,651	29,373	26,778	29,127	30,421
Kerosene	do.	3,693	3,457	4,386	7,041	6,395
Distillate fuel oil	do.	40,669	37,610	38,248	42,277	38,740
Residual fuel oil[e]	do.	22,000	22,000	23,000	24,000	25,000
Unspecified[e, 2]	do.	3,500	3,500	3,500	3,600	3,600
Total[3]	do.	186,000	185,000	189,000	204,000	207,000

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [p]Preliminary. [r]Revised. -- Zero.
[1]Table includes data available through August 25, 2006.
[2]Includes refinery fuel and refinery gains or losses.
[3]Data are rounded to three significant digits; may not add to totals shown.

Sources: Department of Mineral Resources, Mineral Statistics of Thailand; Department of Primary Industries and Mines; Ministry of Commerce, Energy Policy and Planning Office; and U.S. Geological Survey Minerals Questionnaires, 2003-04.

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TABLE 2
THAILAND: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Barite	Asian Mineral Resources Co. Ltd.	Loei, Mae Hong Son, Nakhon Si Thammarat, and Satun Provinces	60
Do.	P & S Barite Mining Co. Ltd.	Loei and Nakhon Si Thammarat Province	60
Cement	Asia Cement Co. Ltd.	Pra Phutthabath, Saraburi Province	4,800
Do.	Jalaprathan Cement Co. Ltd. (Cement Franciais S.A., 37%; Veatprapat Holding Co. Ltd., 19%; others, 44%)	Takli, Nakhorn, Sawarn Province; and Cha-Am, Petchburi Province	2,350
Do.	Samukee Cement Ltd.	Pakchong, Nakhon Ratchasima Province	125
Do.	Saraburi Cement Co. Ltd. (CEMEX Asia Holdings Ltd. of Mexico, 99%)	Chalerm Phrakiat, Saraburi Province	700
Do.	Siam Cement Industry Co. Ltd. (Bureau of the Crown Property, 30%; Thai Security Depository Co. Ltd., 6.94%; CPB Equity Co. Ltd., 5.6%; other financial Institutions and general public, 57.46%)	Kaeng Khoi, Phabhudhabat, and Khao Wong, Saraburi Province; Chae hom, Lampang Province; Thung Song, Thammarat Province; and Ta Luang, Ayutthaya Province	23,200
Do.	Siam City Cement Co. Ltd. (Holcim Ltd. of of Switzerland, 33.7%; Rattanarak family, 27%; other investors, 39.3%)	Kaeng Khoi, Saraburi Province	14,500
Do.	TPI Polene Co. Ltd.	Kaeng Khoi, Saraburi Province	9,900
Coal, lignite	Electricity Generating Authority of Thailand	Mae Moh, Lampang Province;	20,000
Do.	Banpu Public Co. Ltd.	Lampang (LP-2), Lampang Province and Chiang Muan, Phayao Province	3,400
Do.	Lanna Lignite Public Co. Ltd.	Ban Pakha, Lamphun Province	1,000
Copper, refined	Thai Copper Industries Plc (Thai Asset Management, 36%; Thai Film Industry, 27%; Aker Kvarmer, 28%; Industrial Corporation of Thailand Plc, 7%; and others, 2%)	Rayong, Rayong Province	165
Feldspar, concentrate	Asia Mineral Processing Co. Ltd.	Provinces of Nakhon Si Thammarat and Trang	500
Fluorspar, concentrate	Asian Mineral Resources Co. Ltd.	Mae Hong Son Province	14
Gas, natural million cubic meters per day	Esso Exploration and Production Khorat Inc.	Namphong, Khon Kaen Province	4
Do. do.	TOTAL Exploration and Production (Thailand)	Bongkot in the Gulf of Thailand	15
Do. do.	Unocal Thailand Ltd.	Baanpot, Erawan, Funan, Kaphong, Pladang, Satun, Pailin, Trat, all in the Gulf of Thailand	33
Gold kilograms	Akara Mining Ltd. (Kingsgate Consolidated N.L. of Australia, 100%)	Chatree, Pichit Province	5,000
Gypsum	Thai Gypsum Products Pcl. (Thaigips Holdings Ltd., 40.75%; BPB Gypsum B.V., 30%; others, 29.25%)	Nong Bau, Nakhon Sawan Province and Ban Munnak, Phichit Province	2,000
Do.	Vanich Gypsum Co. Ltd.	Khlong Prab, Mai Riang, Thoong Yai Mai in Provinces of Nakhon Si Thammarat and Surat Thani	2,000
Lead, in concentrate	Kanchanaburi Exploration and Mining Co. Ltd.	Song Toh, Nong Phai, and Bo Ngam in Kanchanaburi Province	30
Petroleum, crude, including condensate thousand 42-gallon barrels per day	Chevron Offshore (Thailand) Ltd.	Benjamas, Tantawan, offshore in the Gulf of Thailand	35
Do. do.	Tahi Shell Exploration and Production Co. Ltd.	Sirikit in Kamphaenghet Province	24
Do. do.	TOTAL Exploration and Production (Thailand)	Bongkot, offshore in the Gulf of Thailand	12
Do. do.	Unocal Thailand Ltd.	Baanpot, Erawan, Funan, Gomin, Jakrawan, Kaphong, Pailin, Platon, Satun, Surat, Trat Plamuk, offshore in the Gulf of Thailand	38

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TABLE 2--Continued
THAILAND: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Steel, rolled		The Bangkok Iron and Steel Works Co. Ltd.	Phrapradaeng, Samutprakarn Province	120
Do.		Bangkok Steel Industry Public Co. Ltd.	do.	300
Do.		Millenium Steel Plc (Siam Cement Public Co. Ltd., 45%; McDonald Investment, 6.5%; and other inverstors, 48.5%)	Map Ta Phut, Rayong Province; Sriracha, Chonburi Province; Ban Mon, Saraburi Province	1,700
Do.		Namheng Steel Co. Ltd.	Lopburi Province	300
Do.		Sahaviriya Group Corp. Ltd.	Bang Saphan, Prachuap Khiri Khan Province	2,400
Do.		Siam United Steel Co. Ltd.	Rayong Province	1,000
Do.		G-Steel Plc (formerly Siam Ystrip Mill Plc)	Map Ta Phut, Rayong Province	600
Tantalum, metal powder and oxides	metric tons	H.C. Starck (Thailand) Co. Ltd. (H.C. Starck GmbH, 94.98%, and others, 5.02%)	do.	250
Tin:				
Concentrate		Numerous small companies	Nakhon Si Thammarat, Phangnga, Phuket, and Ranong Provinces	3
Refined		Thailand Smelting and Refining Co. Ltd. (Amalgamated Metal Corp., 75.25%, and other, 24.75%)	Phuket, Phuket Province	30
Zinc:				
In concentrate		Padaeng Industry Public Co. Ltd. (Umicore SA of Belgium, 44.77%; Ministry of Finance, 13.81%; and others, 41.42%)	Mae Sot, Tak Province	65
Refined		do.	Tak, Tak Province	115

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THE MINERAL INDUSTRY OF VIETNAM

By John C. Wu

Vietnam, which is located north of the Gulf of Thailand, west of the Gulf of Tonkin and the South China Sea, east of Cambodia and Laos, and south of China in Southeast Asia, was a low-income developing country. Its per capita gross domestic product (GDP) and GDP based on purchasing power parity were estimated to be $3,024.82 and $251.6 billion, respectively, in 2005. The country's total area is about 329,560 square kilometers (km^2), or slightly larger than the size of New Mexico. As of July 2005, Vietnam had a population of about 84.4 million (U.S. Central Intelligence Agency, 2005§[1]; International Monetary Fund, 2006§).

Vietnam's identified mineral resources were antimony, barite, bauxite, bismuth, carbonate rocks (limestone, and marble), chromium, coal, copper, natural gas, fluorite, gemstones (ruby and sapphire), gold, graphite, iron ore, lead, manganese, nickel, crude petroleum, phosphate rock (apatite), rare earths, silica sand, silver, tin, titanium (ilmenite and rutile), tungsten, zinc, and zircon (Le, Van De, 1996; Lai Hong Thanh, 2002§; Truong Duc Chinh, 2002§). Vietnam was one of the world's leading producers of anthracite coal and one of the region's important producers of ilmenite and phosphate rock. In 2005, Vietnam ranked sixth in production of crude petroleum in the Asia and the Pacific region (Oil & Gas Journal, 2005).

With the exception of carbonate rocks, coal, and hydrocarbons, most mineral resources were largely unexploited owing to Vietnam's outdated mining equipment and technology, poor infrastructure, and uncompetitive Government policy to attract foreign investors in mining. Several foreign mining companies from Australia, Canada, and China, which had began mineral exploration projects in the northern and central parts of Vietnam in the early 1990s, discovered some economically viable deposits of bauxite, copper, fluorspar, gold, nickel, and tungsten during the past 3 years. In 2005, these foreign companies continued their exploration activities by conducting feasibility studies mainly for developing resources of bauxite, bismuth (byproduct), copper, fluorite (byproduct), gold, nickel, and tungsten. The development of gold, copper, nickel, and tungsten resources was expected to begin in the next 2 years, and development of a large-scale bauxite-alumina complex was expected to begin in the next 2 to 4 years. In 2005, Vietnam Coal and Mineral Industries Group (formerly Vietnam National Minerals Corp.) was about to complete its development of the Sin Quyen Copper Complex in Lao Cai Province and was expected to begin the production phase in the first half of 2006. Olympus Pacific Minerals Inc., which had completed development of its Bong Mieu Gold Project, started mining, milling, and processing operations in December 2005.

In 2005, Vietnam's real GDP grew by 8.4% compared with 7.7% in 2004. The higher economic growth in 2005 was the result of a 17.2% increase in industrial sector output, which included construction, manufacturing, mining, and utilities compared with a 10.2% increase in 2004. In 2005, growth in the private industrial sector was 24.6% compared with 20% in the foreign- invested sector and 9% in the state-run sector. The country's inflation rate, however, was also higher at 8.4% compared with 7.7% in 2004 (U.S. Central Intelligence Agency, 2005§; Vietpan.com, 2006§).

The output of the mining and quarrying sector (mostly crude petroleum and natural gas production) accounted for 6.3% of Vietnam's GDP in 2004 (the latest year for which data were available). In 2004, the output value of the mining and quarrying sector at 1994 constant prices was estimated to be $1.46 billion, and Vietnam's GDP at 1994 constant prices was estimated to be $23 billion[2] (International Monetary Fund, 2006).

All minerals, which include coal, natural gas, petroleum, and all nonfuel minerals located within the land, islands, internal waters, sea territory, exclusive economic zones, and continental shelf of Vietnam, are owned by the people and managed by the State. The Ministry of Natural Resources and the Environment (MNRE) had taken over the management of mining activities from the Ministry of Industry in 2004. In Vietnam, all aspects of mining, which include onshore and offshore surveys, exploration, mining, and mineral-processing, are governed and administered by the Law on Minerals of 1996 (Mineral Law) and Decree No. 76/2000/ND-CP of 2000.

Vietnam's production of major mineral commodities included that of barite, chromite, coal, ilmenite, crude petroleum, phosphate rock, tin, and zinc. Most chromite, crude petroleum, and zinc concentrate was exported. Most barite and coal (anthracite) was consumed domestically, but some of the barite and coal production was exported. A Chinese-Vietnamese joint venture company began gold production at the Tan An gold mine in Bac Can Province in February 2004, and Olympus Pacific Minerals Inc. of Canada brought onstream its open pit gold mine and Vietnam's first modern gold processing plant at the Bong Mieu gold property in Quang Nam Province in central Vietnam in December 2005.

The major processed minerals produced were cement, fertilizer materials (ammonia and urea), steel, and refined tin. Cement, fertilizer materials, and steel were for domestic consumption, but some refined tin was exported to Malaysia for further refining to upgrade its tin purity to more than 99%.

In 2005, Vietnam's merchandise trade deficit was reduced by 22.4% to $4.5 billion owing to a 21.6% increase in exports to $32.4 billion and a smaller (15.4%) increase in imports to $37.0 billion. In 2005, despite the large export earnings from crude petroleum, Vietnam remained a net minerals importer because of its large import bill for refined petroleum products, iron and steel products, and nonferrous metal products. The major exports of mineral commodities were crude petroleum ($7.4

[1]References that include a section mark (§) are found in the Internet References Cited section.

[2]Value has been converted from Vietnamese Dong (D) to U.S. dollars (US$) at a rate of D15,745=US$1.00 for 2004.

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billion), coal ($670 million), and tin ($13 million). Exports of crude petroleum alone accounted for 22.7% of Vietnam's total export earnings. The major imports of mineral commodities were refined petroleum products ($5.0 billion), iron and steel products ($2.9 billion), nonferrous metals ($797 million), fertilizer materials ($641 million), and cement clinker ($127 million). Imports of refined petroleum products and iron and steel products accounted for 13.5% and 7.9%, respectively, of Vietnam's total import bills (Ven Online, 2006a§, c§).

Commodity Review

Metals

Bauxite and Alumina and Aluminum.—According to Vietnam's geological agencies, the country's estimated bauxite resources, which are concentrated in the Provinces of Dak Lak, Dak Nong, Dong Nai, Kon Tum, and Lam Dong in Vietnam's central highlands, totaled about 8 billion metric tons (Gt). BHP Billiton Aluminium of Australia, which established a representative office in Hanoi, was ready to invest $40 million in the initial exploration program to assess the feasibility of undertaking a $1.6 billion bauxite mine and alumina refinery project in Dak Nong Province. In April 2005, BHP Billiton Aluminium reportedly encountered some difficulties in obtaining an exploration license from MNRE. Dak Nong Province reportedly has seven bauxite deposits, which include the 1-5, the Quang Son, the Gia Nghia, and four other deposits, with a preliminary bauxite ore reserves estimate of about 2.7 Gt. In 2005, the Government reportedly agreed to allow Vietnam National Coal Corp. (VINACOAL) to work on an exploration and mining project at the Gia Nghia deposit where ore reserves were estimated to be 300 million metric tons (Mt) (Vn-style.com, 2005a§).

The state-owned Vietnam National Chemical Corp., through its affiliate, Southern Basic Chemical Co. (SBCC), was expected to undertake a $25 million project in the Bao Loc District, Lam Dong Province. SBCC was to develop a 200-hectare complex to mine bauxite ore and to refine ore into aluminum hydroxide for water-filtering plants and into alumina for aluminum smelters. The aluminum hydroxide project in Lam Dong Province was expected to start operations by the end of 2005 with the capacity to produce 100,000 metric tons per year (t/yr) of aluminum hydroxide mostly for export to China, Japan, and the Republic of Korea (Vn-style.com, 2005b§).

In December 2005, Aluminum Corporation of China (CHALCO) signed a memorandum of understanding (MOU) with VINACOAL for the joint development of a bauxite and alumina project in Dak Nong Province. According to the MOU, CHALCO proposed to invest about $2 billion for the development of a bauxite mine and alumina refinery. According to CHALCO, the alumina refinery will have the capacity to produce 1.9 million metric tons per year (Mt/yr) in the first phase, and the capacity will be expanded to 4 Mt/yr in the second phase. CHALCO also proposed to conduct a feasibility study for constructing a power generation plant and an integrated aluminum smelter. However, the Vietnamese Government had not yet approved the proposal submitted by CHALCO. CHALCO initially proposed to have the Vietnam National Minerals Corp. (VIMICO) as its partner in the joint development project, but the Vietnamese Government assigned VINACOAL to replace VIMINCO as CHALCO's partner (CNMN.com.cn, 2005§; Platts.com, 2005§).

Copper.—The state-owned Vietnam Coal and Mineral Industries Group (a company formed from the merger of two formerly state-owned companies, VINACOAL and VIMICO, on December 26, 2005), which was the investor in the complex, announced that the Sin Quyen Copper Complex in Lao Cai Province was expected to be completed and to begin commercial operations during the first half of 2006. The construction works for the mining and milling facilities was awarded to Vietnam Industrial Construction General Corporation as primary contractor. The mining and milling complex would have the capacity to mine and process between 1.1 and 1.2 Mt/yr of ore to produce 42,000 t/yr of copper concentrate at an average grade of 25% copper, more than 113,000 t/yr of iron ore concentrate, and about 20,000 t/yr of pyrite ore (sulfur) as coproducts, and gold, silver, and sulfuric acid as byproducts. The total capital investment of the project was about $81.6 million (Vietpartners.com, 2006§).

Gold.—In October 2005, Olympus Pacific Minerals Inc. of Canada completed construction of its Bong Mieu gold mine on budget and on schedule and began its gold production in December 2005 (Olympus Pacific Minerals Inc., 2005b§, c§). Earlier in 2004, a joint venture of Bac Can Mineral Co. and Jin Ping Steel of China reportedly announced that its gold production had begun at the Tan An gold mine in Bac Can Province (Mining Journal, 2005c).

Other foreign companies, such as Anh Kim Joint Venture Co. of Malaysia in Ea Ba Commune of Phu Yen Province, Archipelago Resources PLC of the United Kingdom in the Cam Thuy-Ba Thuoc gold district, and Kim Binh Zinc Co. Ltd. of China in Lang San Commune of Na Ri District, continued their active gold exploration in 2005.

In March 2005, Triple Plate Junction Ltd., which was owned by Triple Plate Junction Plc (TPJP) of the United Kingdom (51%) and Newmont Vietnam Pty Ltd. (49%), was granted two exploration licenses for the core area of 154 km^2, which covers six identified targets at the promising Pu Sam Cap gold prospect in Lai Chau Province. These two exploration licenses reportedly were the first new exploration licenses issued by the Government of Vietnam since 2001. By September, TPJP had established an operational base in Lai Chau Province and a logistics-support network for field teams at Pu Sam Cap, reviewed existing geologic data of Pu Sam Cap, and conducted infill reconnaissance sampling (Triple Plate Junction Plc, 2005a§, b§).

In September 2005, Amanta Resources Ltd. of Canada reportedly had applied for exploration licenses for two gold prospecting areas at Lang Alao and Haroon in An Khe Province in Vietnam Central Highlands (Amanta Resources Ltd., 2005§).

Olympus Pacific Minerals, which completed construction of an open pit gold mine at the Ho Gan deposit and Vietnam's first modern gold processing plant (a pilot plant) at the Bong Mieu Mines in October 2005, started gold production in December 2005. The initial mining and ore-processing operations in

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December and the following 6 months would be at a rate of 500 metric tons per day (t/d) of low-grade feedstock until the plant settled in; then, the amount of higher-grade feedstock would be increased gradually to achieve the 800-t/d design capacity during the first half of 2006. As a result of a diamond-drilling program carried out in November 2004, the updated Ho Gan open pit proven and probable resource estimates increased by 29.6% to 1,111,900 metric tons (t) at a grade of 2.36 grams per metric ton (g/t) gold or about 2,622 kilograms (kg) or 84,300 troy ounces (oz) of gold, which is about 27% more than the previous estimate of 66,550 oz in 2004 (Olympus Pacific Minerals Inc., 2005a§-d§).

Olympus Pacific Minerals' 85% owned Phuoc Son gold property, which is located 90 kilometers (km) southwest of Danang in Quang Nam Province, has 34 known areas of outcropping gold mineralization; of these 34, the Dak Sa and the Northern sectors are the most advanced prospects. According to Olympus Pacific Minerals, a prefeasiblity/feasibility study for developing an underground mine with pilot-scale gold production from the Bai Dat and the Bai Go deposits in the Dak Sa sector was completed by Micon International Ltd. in May 2005, the Environmental Impact Assessment (EIA) report had been approved by the MNRE in December 2004, and Olympus Pacific Minerals was anticipating Government approval of the mining license in early 2006. As of January 2004, measured and indicated mineral resource estimates for the Bai Dat and the Bai Go deposits totaled 318,000 t at a grade of 14.32 g/t and contained 4,570 kg or 147,000 oz of gold (Olympus Pacific Minerals Inc, 2005e§).

Iron and Steel.—Vietnam's iron ore deposits totaled about 200, according to Vietnam Government sources, and the country's estimated iron ore reserves totaled about 1.2 Gt. Of the 200 deposits, 13 have iron ore reserves of more than 1 Mt each. Most iron ore deposits in Vietnam are located in the northern part of the country and have an average ore grade of 50% iron. Iron ore mines in Vietnam were controlled by the Vietnam Mining Corp. and state-owned Vietnam Steel Corp. (VSC), which hold the right to explore and exploit iron ore. In 2005, Thai Nguyen Iron and Steel Corporation (TISCO), which was a subsidiary of VSC, operated two mines at the Trai Cau and the Tien Bo in Thai Nguyen Province. The iron ore production capacity of the Trai Cau Mine was about 300,000 t/yr, and the Tien Bo Mine had the capacity to produce about the same quantity. In 2005, VSC reportedly was negotiating with Essar Group of India to jointly explore for iron ore at the Thach Khe Mine in Ha Tinh Province. The Thach Khe Mine and the Quy Xa Mine in Lao Cai Provice are two of the country's leading iron ore mines with iron ore reserves of about 544 Mt and 112 Mt, respectively (Southeast Asia Iron and Steel Institute, 2005a§).

A Chinese-Vietnamese joint venture agreement was signed in September 2004 for the development of an iron ore mine at Qui Sa (Quy Xa) and construction of a 500,000 t/yr steel billet plant in Lao Cai. The total capital investment for the two projects would be between $240 million and $260 million, of which between $40 and $60 million would be for the development of the Qui Sa Mine, and $200 million, for the construction of a steel billet plant. The Qui Sa Mine, which has iron ore reserves estimated to be about 120 Mt, would have the capacity to produce from 2.5 to 3 Mt/yr, of which between 1 and 1.5 Mt/yr would be exported to China in exchange for fat coal (high-volatile coal used for the manufacture of coke) and coke; 500,000 t/yr would be delivered to a steel plant in Thai Nguyen Province; and the remaining 1 Mt would go to the 500,000 t/yr steel plant to be built in Lao Cai Province. The iron ore project was scheduled to start in early 2006 with an initial production of 1.5 Mt/yr. The joint venture is owned by VSC and the Lao Cai Mineral Co. (51% combined) and by Kunming Iron and Steel Co. of Yunnan Province, China (49%), which was expected to provide capital, technology, and equipment for mine development (Chinadaily.com.cn, 2004§).

Vietnam's steel industry continued to have an imbalance between upstream (production of crude steel) and downstream (rolled steels) in 2005. Domestic crude steel production was by three subsidiaries of VSC (Danang Steel Company, Southern Steel Co., and Thai Nguyen Iron and Steel) and the Hoa Phat Company (a private billet producer). Vietnam produced about 780,000 t of crude steel in 2005. To meet the domestic requirements for steel ingot and billet in 2005, Vietnam imported 2.23 Mt of steel billet valued at $837 million (Ven Online, 2006c§). In 2005, Vietnam consumed about 3.5 Mt of steel billet, of which 71.4% was met by imports. According to the Vietnam Steel Association (VSA), Vietnam had seven steel billet producers with combined annual capacity of about 1.5 Mt. Imports of steel billet were mainly from China, Malaysia, Russia, and Ukraine. Southern Steel and Thai Nguyen Iron and Steel, which held a combined local market share of about 40%, were two major steel billet producers that used domestic iron ore and scraps. Five other steel billet producers relied heavily on imports of higher-priced steel scrap (Southeast Asia Iron and Steel Institute, 2005b§).

According to the VSA, Vietnam imported about 200,000 t of steel scrap in 2005. Vietnam's steel scrap imports were projected to increase to 1 Mt in 2006 and to 2 Mt in 2007 because several new steel plants that use steel scraps for making steel billet were expected to be brought onstream in 2006 and 2007. In 2006, Vietnam's steel billet requirements were expected to increase to 4 Mt, domestic billet production was expected to increase to 1.5 Mt, and steel billet imports were expected to reach 2.5 Mt (Southeast Asia Iron and Steel Institute, 2006a§, b§).

To reduce import reliance on steel, VSC focused on eight projects to be implemented between 2006 and 2010 to boost steel-production capacity, especially production of those steel products currently imported. VSC planned to launch three projects in 2006 that would be completed in 2008. These projects were the second-phase expansion of Thai Nguyen Iron and Steel to raise steel billet production capacity by an additional 500,000 to 800,000 t/yr; the initial production of 1.5 Mt/yr of iron ore at Qui Sa in Lao Cai Province by the joint venture of Qui Sa (Quy Xa) Mine Exploitation Company and China's Kunming Iron and Steel Co.; and the production by the same joint venture of between 1.5 and 2 Mt/yr of hot-rolled coil and plate at a plant to be located in the south in Ba Ria-Vung Tau Province (Southeast Asia Iron and Steel Institute, 2006c§).

According to the VSA, Vietnam's steel consumption was projected to grow by 10% in 2006. Vietnam's demand for

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finished steel products was estimated to be 6.1 Mt in 2005 compared with 5.7 Mt in 2004. For the first 11 months of 2005, long products (for construction) produced by VSA members totaled 2.35 Mt, and that of non-VSA members, about 500,000 t. For the first 11 months of 2005, imports of finished steel products (mostly flat products) totaled 2.5 Mt (Southeast Asia Iron and Steel Institute, 2005c§). In 2005, imports of steel (excluding steel billet) totaled 3.3 Mt valued at $2.1 billion. The major suppliers of steel to Vietnam were, in decreasing order, China, Japan, Russia, Taiwan, the Republic of Korea, Thailand, Malaysia, and Ukraine (Ven Online, 2006b§, c§).

Nickel.—Asian Mineral Resources Ltd. (AMR) of New Zealand, completed a feasibility study in 2005 for the development of copper and nickel at its 90% owned Ban Phuc Nickel property in the 150-km^2 Ta Khoa concession, which is located about 180 km west of Hanoi in the Province of Son La. The study was completed by a group of consultants led by Ausenco Ltd. The feasibility study supported the development of a 200,000-t/yr underground mining operation and conventional sulfide flotation plant to produce about 4,000 t/yr of nickel and 2,000 t/yr of copper in a bulk concentrate. Under the base case mine plan, the mine was expected to produce 21,201 t of nickel and 9,915 t of copper in concentrate during the 5.25-year mine life. The preliminary startup capital cost estimate for the project was $33.6 million inclusive of contingencies.

The updated massive sulfide vein resources at the Ban Phuc nickel property included 0.61 Mt of measured resources at grades of 2.66% nickel, 1.09% copper, and 0.09% cobalt; indicated resources of 0.62 Mt at grades of 2.88% nickel, 1.16% copper, and 0.09% cobalt; and inferred resources of 0.26 Mt at grades of 2.43% nickel, 1.16% copper, and 0.09% cobalt. The estimated total massive sulfide vein resources, which included only measures and indicated estimates at a 0.4% nickel cutoff grade, were 1.23 Mt at grades of 2.77% nickel, 1.13% copper, and 0.09% cobalt. The updated massive sulfide vein reserves at the Ban Phuc nickel property included 0.46 Mt of proven reserves at head grades of 2.5% nickel and 1.0% copper and 0.55 Mt of probable reserves at head grades of 2.3% nickel and 1.0% copper. The estimated total massive sulfide vein reserves were 1.01 Mt at head grades of 2.4% nickel and 1.0% copper (Asian Mineral Resources Ltd., 2005§).

According to AMR, the company expected that a mining license for the mine development of the Ban Phuc property could be approved by the Vietnamese Mineral Resources Evaluation Council of the MNRE by mid-2006, which would allow production to start in 2007. In July 2005, AMR signed an agreement with state-owned Mineral Development Co. Ltd. to purchase an additional 20% equity interest and increased AMR's holding in the Ban Phuc project to 90%. The remaining 10% interest was held by Son La Engineering and Construction Co. Ltd., which was owned by the Son La Provincial Government (Mining Journal, 2005a, b).

Titanium, Ilmenite.—Estimated production of ilmenite held steady within a narrow range of from 180,000 t to 200,000 t during the past 5 years. In 2005, about 156,000 t of ilmenite was exported to Japan. According to Xinhua News Agency of China, Vietnam was planning to cease exports of ilmenite with titanium dioxide content of from 53% to 57% beginning in 2008. According to Vietnam News Brief Service, Vietnamese enterprises are not allowed to export raw materials, which included ilmenite, rutile, and zircon. Under a regulation announced and published by the Ministry of Industry in August 2005 as a guide for minerals exports during 2005 to 2010, local enterprises are allowed to export only processed minerals that meet Vietnam Laboratory Accreditation Scheme (VILAS) standards and must abide by export regulations for each type of mineral. Contracts for the exports of raw materials signed before the enforcement of this regulation were allowed to continue until September 20, 2005 (Tzmi.com, 2005a§, b§).

The Government of Vietnam had approved a $25 million project proposed by Altair Nanotechnologies Inc. in 2004 to produce, process, and export titanium oxide pigment. Lidisco, which is a subsidiary of Vietnam Mineral Resource Department, was to develop the project, which would be capable of producing about 10,000 t/yr of titanium oxide pigment. Altair reportedly had an agreement with Avirco USA, LLC to evaluate Altair's technology for the project. Under the project plan, Altair would select an engineering and construction management contractor to design and manage the construction of operational modular facilities for the production of titanium oxide pigment using Altair's patented process. The new facilities would have an initial capacity of 5,000 t/yr and would later expand to 10,000 t/yr or more for export (Industrial Minerals, 2004).

Tungsten.—In 2005, Tiberon Minerals Ltd. of Canada made significant progress toward the development of its 77.5% owned Nui Phao tungsten/fluorspar project, which is located about 80 km north of Hanoi in Thai Nguyen Province.

In January 2005, Tiberon Minerals, through Aker Kvaerner Canada Inc., completed an interim feasibility study. The study confirmed that the development would be economical and have a low operating cost. The capital cost, however, increased to $211 million from the $140 million estimated under a prefeasibility study conducted by a group of consultants led by AMEC E&C Services Ltd. of Canada in 2003. The plan under this interim feasibility study calls for production of 4,319 t/yr of tungsten trioxide, 222,680 t/yr of fluorite, 5,531 t/yr of copper, 912 t/yr of bismuth, and about 95 kilograms per year (kg/yr) or 2,950 troy ounces per year (oz/yr) of gold. The 2003 prefeasibility study proposed production of 6,000 t/yr of tungsten trioxide, 196,000 t/yr of fluorite, 5,600 t/yr of copper, 360 t/yr of bismuth, and about 156 kg/yr or 5,000 oz/yr of gold. Proven and probable reserves at Nui Phao were 53.1 Mt at grades of 0.21% tungsten trioxide, 8.34% fluorite, 0.19% copper, 0.10% bismuth, and 0.21 g/t gold (Tiberon Minerals Ltd., 2003§, 2005d§).

In March 2005, Tiberon Minerals received approval of the environmental impact assessment (EIA) report for its Nui Phao tungsten/fluorspar deposit by the Government of Vietnam. Three months after the approval of the EIA report, a mining license was officially granted by the Government to Tiberon Minerals to develop and mine the Nui Phao tungsten/fluorspar deposit (Tiberon Minerals Ltd., 2005e§, f§).

In May 2005, Tiberon Minerals announced that it had signed two tungsten offtake contracts with OSRAM Sylvania of the United States. Under terms of the initial (base) contract, OSRAM Sylvania agreed to purchase about 44% of Nui Phao's projected tungsten concentrate output for a minimum of 5 years

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with an option to increase its offtake to 100%, subject to certain conditions. Should both the base contract and option be fully exercised, the agreement would cover 15 years and be worth about $1.2 billion in tungsten revenue to the Nui Phao project based on the prevailing ammonium paratungstate prices. In 2005, Tiberon Mineral also signed another offtake contract with OSRAM Bruntal spol. s.r.o. of the Czech Republic. The terms of the contract with Bruntal, however, were not disclosed (Tiberon Minerals Ltd., 2005c§).

In July 2005, Tiberon Minerals announced the completion of its final feasibility study report, which was conducted and prepared by Aker Kvaerner. The study concluded that an open pit mine with total capital costs of $229.8 million could produce a total of about 76,000 t of tungsten trioxide, 3.5 Mt of acid-grade fluorite, 90,000 t of copper, 32,000 t of bismuth, and 1,150 kg or 37,000 oz of gold over a 16.3-year mine life, generating a 23.6% after-tax internal rate of return, assuming that project financing was based on a 75:25 debt-to-equity ratio. The updated ore reserve estimate at Nui Phao was 55.7 Mt at grades of 0.21% tungsten trioxide, 8.13% fluorite, 0.19% copper, 0.09% bismuth, and 0.21 g/t gold (Tiberon Minerals Ltd., 2005a§).

In August 2005, Tiberon Minerals announced that it had successfully completed (secured) the Canadian $80 million (US$65 million) equity portion financing package for the development activities at the Nui Phao Project. The company was expected to complete the debt portion of the overall project financing by early 2006 and to be on track to meet its projected initial startup in the fourth quarter of 2007; commercial production was expected to begin in early 2008 (Mining Journal, 2005c; Tiberon Minerals Ltd., 2005b§).

Industrial Minerals

Cement.—According to the Ministry of Construction, Vietnam's cement production increased by more than 14.5% to 29 Mt in 2005 because of the continued growth in the industry's capacity and strong domestic demand for cement for major infrastructure, private housing, and office building projects. Cement consumption increased by more than 14% to 29.5 Mt in 2005 and was projected to be more than 30 Mt in 2006; it was expected to continue to grow by between 10% and 12% per year and to reach 48 Mt in 2010. According to Vietnam's General Department of Customs, Vietnam imports of clinker increased by 12.7% to 4.35 Mt valued at $126.67 million in 2005. According to the Ministry of Construction's forecast, the Vietnamese cement industry was expected to import about 5 Mt of clinker in 2006 (Cementchina.net, 2006§; Ven Online, 2006b§, c§).

Vietnam's cement industry, which had 13 reverter-furnace (rotary kiln) cement plants, 53 blast-furnace (vertical or shaft kiln) cement plants, and 33 cement-grinding plants, was projected to produce 32.5 Mt of cement in 2006, of which the state-owned Vietnam National Cement Corp. (VNCC) was projected to produce 13.3 Mt; foreign-invested companies, 10 Mt; and domestic private producers, 9.2 Mt in 2006 (Aggregate Research.com, 2006§).

During 2005, VNCC reportedly was working on eight projects to build five new cement plants and to install three new production lines. The new cement plants are the Binh Phuoc cement plant in Binh Phuoc Province; the Ha Tien II-2 cement plant in Kien Giang Province; and the Cam Pha, the Ha Long, and the Thang Long cement plants in Quang Ninh Province. The new production lines would be installed at the Hoang Thach plant in Hai Duong Province, the Bim Son plant in Thanh Hoa Province, and the But Son plant in Ha Nam Province. These eight new projects would add 14.8 Mt/yr to VNCC's existing 18-Mt/yr capacity (table 2). According to an estimate by the Ministry of Construction, the eight cement projects would cost at least $1.4 billion in investment capital (Vietpartners.com, 2005§).

In June 2005, Vietnam Construction Import-Export Corporation (VINACONEX) started construction work on one of the country's major integrated cement plants in the town of Cam Pha. The Cam Pha cement plant would have a design capacity of 1.89 Mt/yr of clinker and 2.3 Mt/yr of portland cement. The total capital cost of the project was estimated to be $301.9 million (D4.74 trillion). To finance the project, VINACONEX signed a $98.2 million (€76 million) credit agreement with three foreign banks for the procurement of equipment for the cement plant. Under the agreement reached between VINACONEX, the Japan Bank of International Cooperation (JBIC), and the two French banks, Societe Generale (SG) and BNP Paribas, the Vietnamese partners would buy equipment worth $46.5 million (€36 million) from Japan's Kawasaki group via JBIC and would import equipment worth $51.7 million (€40 million) from ABB Ltd. of Switzerland and FAM Magdeburger Förderanlagen und Baumaschinen GmbH, Haver & Boecker Drahtweberei und Maschinenfabrik, and Leosche GmbH of Germany via SG and BNP Parisbas banks for the Cam Pha cement plant. According to VINACONEX, the Cam Pha grinding station would start operation by April 2006 (Asia Times Online, 2005§; Cemenchina.net, 2005§).

Another announced major cement project to be undertaken between 2005 and 2008 was construction of a new production line by Nghi Son Cement Corp. [a foreign-invested joint venture of Taiheiyo Cement Corp. (45.5%), VNCC (35%), and Mitsubishi Materials Corporation (19.5%)] to double the existing capacity of 2.15 Mt/yr to 4.3 Mt/yr by 2008. The Government reportedly had issued an investment permit on the planned investment of $240 million, and construction of the second production line was to begin in late 2005. When the construction is completed in 2008, Nghi Son cement plant would be Vietnam's largest (in terms of production capacity) cement plant (Mitsubishi Materials Corporation, 2005§).

Mineral Fuels

Coal.—The Vietnamese coal industry continued the 2004 robust growth path with coal production and coal exports at a record-high level in 2005 owing to a dramatic expansion in coal production capacity and the stronger coal demand in the domestic and overseas markets, especially in China, Japan, and Thailand. Coal production reached a record-high level of 32.8 Mt in 2005 compared with 27.3 Mt in 2004, and coal exports jumped by 55% to a record-high level of 18.0 Mt compared with 11.6 Mt in 2004. In 2005, Vietnam was one of the world's

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leading anthracite coal exporters and accounted for 13% of the world market (Coal Prep e-Informer, 2006§; Ven Online, 2006d§).

In 2005, the Government reported that the coal sector reached its 2005 target before the year's end. The coal sector had set a coal production target of 40 to 50 Mt by 2010 and the Red River Delta would become the primary source of coal. During the first 11 months of 2005, the industry produced more than 31.3 Mt of coal, which was 5% higher than the 2005 target and 27% more than that of the same period in 2004. Of the 31.3 Mt produced, 27.5 Mt was clean coal, which was 21% more than that of the same period in 2004. During the first 11 months, the coal industry sold more than 26.5 Mt, of which 12.8 Mt was exported and 13.7 Mt was sold in the domestic market. The state-owned VINACOAL estimated that the company would sell 29.5 Mt of coal in 2005, of which 15.3 Mt would be for domestic consumption and 14.2 Mt would be exported (Vietpan.com, 2005a§; Vietnam Economic News, 2006§).

The growth in coal demand for the generation of electricity continued to fuel the overall domestic demand for coal in 2005. The cement and fertilizer industries were two other major consumers in the domestic coal market. According to the Electricity of Vietnam (EVN), EVN planned to build a total of 52 powerplants, of which 42 would be hydroelectric plants; 6, coal-fired thermal powerplants; and 4, gas-fed plants during 2006-10. VINACOAL also planned to build eight coal-fired thermal powerplants with a total capacity of 2,900 megawatts (MW) by 2010. By 2010, the total coal-fired power generation capacity was expected to grow more than twofold to more than 4,100 MW, and more than 16 Mt of coal was expected to be consumed by coal power stations by 2020. According to a forecast by EVN, coal-fired powerplants accounted for between 13% and 15% of Vietnam's total power output in 2005, and this percentage share was expected to increase to 25% by 2010 (Vietnam Economy, 2005a§; Coal Prep e-Informer, 2006§).

In 2005, VINACOAL controlled most of the mining, distribution, and export of coal. Most of the coal produced in Vietnam was anthracite mainly from Quang Ninh Province in northeastern Vietnam. Under VINACOAL's expansion program, which was announced in 2003, it planned to open six open pit coal (anthracite coal) mines at Khe Cham in Quang Ninh Province during the 2004-10 time period. The Khe Cham No. 1 Mine (600,000-t/yr capacity) was opened in 2004, the Khe Cham No. 2 Mine was scheduled to open in 2007 with capacity to reach 1.2 Mt/yr by 2009, the Khe Cham No. 3 Mine (1.5 Mt/yr) will open by 2010; the Khe Cham No. 4 Mine (1.5 Mt/yr) opened in 2003. Other major coal mines were located in the areas of Cam Pha, Cao Son, Coc Sau, Deo Nai, Dong Trieu, Ha Tu, Hong Gai, the Mao Khe, Mong Duong, and Uong Bi. Production of brown coal was mainly from the Na Duong Mine, which is located in the Province of Lang Son. VINACOAL's three main coal preparation (processing) plants were located in Cam Pha, Hong Gai, and Uong Bi and had a total combined design capacity of 6 Mt/yr. VINACOAL also controlled three main coal terminals at Cua Ong in Cam Pha, Dien Cong in Uong Bi, and Nam Cau Trang in Hon Gai.

In December 2005, VINACOAL reportedly was in talks with Kuzabassproservice, which is a Russian Industrial Service company, to cooperate in a coal exploration and development project in the Red River region. The Russian firm exhibited machinery and equipment for mining and tunnel construction at an international fair for the power, mining, and metal processing industries in Hanoi in 2005 (Vietpan.com, 2005b§).

In 2005, according to Government trade statistics, Vietnam's coal exports totaled 17,986,463 t, of which about 44% went to China, and 14%, to Japan. Other main buyers of Vietnamese coal were the Republic of Korea and Thailand (Ven Online, 2006a§).

Natural Gas and Petroleum.—Natural gas was produced by VietSovPetro (a joint venture of Vietnam Oil and Gas Corp. and Zarubeznheft of Russia) from the small onshore Tien Hai C Gasfield in the Hanoi Trough (which is part of the Song Hong Basin). Associated gas was produced by VietSovPetro from the larger offshore Bach Ho (White Tiger) and Rang Dong (Dawn) oilfields, which are located in the Cuu Long Basin. A consortium led by BP p.l.c. of the United Kingdom produced associated gas from the offshore Lan Tay and Lan-Do gasfields in the Nam Con Son Basin. In 2005, natural gas production increased slightly to 6.34 billion cubic meters and averaged about 17.12 million cubic meters per day (Danmarks Ambassade Vietnam, 2006§; Ven Online, 2006e§). In April 2005, state-owned PetroVietnam announced that its subsidiary PetroVietnam Investment and Development Company discovered a gasfield at the Dong Quang D-1X well in the Hon River (Red River) basin. Three of the four newly drilled holes were 1,650 meters deep and were estimated to be able to produce between 30,000 and 35,000 cubic meters per day of natural gas. The natural gas production from the well was delivered to several ceramic and glass plants at the Tien Hai Industrial Park in Thai Binh Province.

In the domestic market, natural gas was consumed as fuel by powerplants and as raw materials by a nitrogen fertilizer plant in the Phu My Industrial Zone in the Province of Ba Ria-Vung Tau; the remainder was consumed as raw materials by the liquefied-petroleum-gas (LPG)- and condensate-processing plants at Dinh Co for the production of LPG and gasoline in Vung Tau in the Province of Ba Ria-Vung Tau. In April 2005, the Phu My power center, whose capacity of 3,859 MW was equivalent to 40% of the national grid's designed capacity, was inaugurated in the Tan Thanh District of Ba Ria-Vung Tau Province in southern Vietnam. The center, which was the country's largest in terms of capacity, supplied more than 23 billion kilowatthours per year and consumed more than 4.1 billion cubic meters of natural gas. The Phu My power center has a total of six powerplants. Two of these powerplants (Phu My 3 and Phu My 2.2, which had a combined capacity of 1,435 MW) were built by foreign investors under a build-operate-transfer scheme, and four of them (Phu My 1, Phu My 2.1, extended Phu My 2.1, and Phu My, which had a combined capacity of 2,424 MW) were built by EVN (Vietnam Economy, 2005a§, b§).

Crude petroleum was produced by PetroVietnam in joint venture with partners from Canada, France, Japan, Malaysia, Russia, Sweden, and the United States. In 2005, Vietnam's crude petroleum production decreased to 18.5 Mt, or by an average of 371,500 barrels per day (bbl/d), from 20.17 Mt, or by an average of 391,400 bbl/d, in 2004. The country exported about 18 Mt

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of its crude petroleum output and earned $7.4 billion of foreign currency in 2005. The major buyers of Vietnam crude petroleum were China, Japan, Malaysia, Singapore, and the United States in 2005 (Thanhnien News, 2006§; Ven Online, 2006a§; Vietnam Economy, 2006§).

In 2005, crude petroleum was produced from the Bach Ho, the Rang Dong, the Rong, the Ruby, and the Su Tu Den (Black Lion) fields in the Cuu Long Basin; the Bunga Kekwa field in the Malay-Tho Chu Basin, which is located off the southern coast of Vietnam between Vietnam and Malaysia; and the Dai Hung field in the Nam Con Son Basin.

Construction of Vietnam's much-delayed first oil refinery—the Dung Quat oil refinery, which is located about 850 km south of Hanoi in Quang Nam Province—finally began in November 2005. The groundbreaking ceremony for the construction was held on November 28, 2005. The $2.5 billion project involves an oil refinery, a pipeline that connects to a port in the coastal area, and storage facilities. According to PetroVietnam, the refinery was designed to process 6.5 Mt/yr or 130,000 bbl/d of crude petroleum. The plant was expected to be completed in 44 months. Technip Group of France led an international consortium of contractors, which included JGC Corporation of Japan and Teenicas Reunidas of Spain, to construct the oil refinery (Embassy of Vietnam in the United States, 2005§).

Outlook

For the next 4 to 5 years, the country's mining sector will continue to be dominated by the coal and oil and gas industries. In the energy sector, the coal and oil and gas industries are expected to expand their capacity during the next 2 to 4 years. The mining sector for ferrous, nonferrous, and industrial minerals also is expected to expand. Exploitation of such nonferrous minerals as copper, gold, and zinc is expected to start between 2006 and 2007 and to add new capacity to the mining sector. Development of new capacity for the production of fluorspar, iron ore, nickel, and tungsten could be completed between 2007 and 2008, but development of new capacity for alumina and bauxite may take longer. The existing capacity for production of cement is expected to be expanded by more than 14 Mt/yr during the next 3 to 5 years to meet the growing demand for cement as a result of Vietnam's rapid urbanization.

Vietnam's economy is expected to continue to grow at a rate of slightly less than 7.5% during the next 2 years. According to a forecast by the International Monetary Fund, the Vietnamese GDP is estimated to grow at a rate of 7.4% in 2006 and 2007 (International Monetary Fund, 2006§).

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TABLE I

VIETNAM: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2001	2002	2003	2004[e]	2005[e]
Barite[e]		71,100	60,300	81,500	101,000 [3]	116,000
Bauxite[e]		20,000	20,000	20,000	20,000	20,000
Cement, hydraulic	thousand metric tons	16,073	21,121	24,127 [r]	25,320 [3]	29,000 [3]
Chromium ore, gross weight[e]		70,300 [3]	80,000	120,000	150,000	85,000
Clays, kaolin[e]		600,000	600,000	650,000	650,000	650,000
Coal, anthracite	thousand metric tons	13,397	16,347	19,590	27,330 [r, 3]	32,800 [3]
Copper concentrate, gross weight[e]		1,600	1,100	1,200	1,500	2,000
Fluorspar[e]		3,000	3,000	3,000	3,000	3,000
Gas, natural, gross	million cubic meters	1,724	2,260	3,450	6,250 [3]	6,340 [3]
Gold[e]	kilograms	3,000	2,000	2,000	2,000	3,000
Iron ore[e]		400,000	430,000	540,000	650,000	700,000
Lead, mine output, Pb content[e]		900	1,100	1,100	1,100	1,200
Lime	thousand metric tons	1,351	1,426	1,450 [e]	1,500	1,500
Manganese concentrate, gross weight[e]		67,000	68,000	68,000	70,000	70,000
Nitrogen, N content of ammonia		52,600	58,400	79,700	216,200 [3]	220,000 [3]
Petroleum, crude	thousand 42-gallon barrels	119,212	117,753	125,281	142,844 [3]	135,578 [3]
Phosphate rock:						
Gross weight	thousand metic tons	677	680	823	800	800
P_2O_5 content	do.	204	204	247	240	240
Pyrite, gross weight[e]	do.	300	400	450	450	500
Pyrophyllite[e]		30,000	30,000	30,000	30,000	30,000
Salt	thousand metric tons	669	1,089	1,275 [e]	1,300	1,400
Sand and gravel	do.	92,200	95,000	98,000 [e]	98,000	100,000
Silica sand[e]	do.	62,000	62,000	63,000	63,000	63,000
Steel:						
Crude	do.	319	409	544	658 [3]	780
Rolled	do.	1,914	2,503	2,954 [r]	2,929 [r]	3,570
Stone, building stone	do.	80,400	83,700	85,000 [e]	90,000	100,000
Sulfur[e]		22,000	22,000	22,000	22,000	22,000
Tin:[e]						
Mine output, Sn content		1,700	1,700	2,100	3,500	3,500
Metal, smelter		1,700	1,700	2,100	3,500	3,500
Titanium, ilmenite, gross weight[e]		180,000	180,000	200,000	200,000	180,000
Zinc, mine output, Zn content[e]		32,000	42,000	45,000	30,000 [r]	32,000
Zirconium, gross weight[e]		8,000	11,000	13,000	13,000	13,000

[e]Estimated; estimated data are rounded to no more than three significant digits. [r]Revised.

[1]Table includes data available through May 26, 2006.

[2]In addition to the commodities listed, antimony, bentonite, refractory clay, construction aggregates, gemstones, granite, graphite, marble, rare earths, and silver were mined but not reported. Available information is inadequate to make reliable estimates of output levels.

[3]Reported figure.

Sources: Vietnam's General Statistics Office, Statistical Yearbook, 2002; British Geological Survey, World Mineral Statistics, 2001-03; World Metal Statistics, May 2005; South East Asia Iron and Steel Institute, Crude Steel Production, Annual Statistics, 2001-04; The Barytes Association, World Barytes Production 2001-05; International Lead and Zinc Study Group, Lead and Zinc Statistics, Monthly Bulletin of the International Lead and Zinc Study Group, February 2006.

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TABLE 2
VIETNAM: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Thousand metric tons unless otherwise specified)

Commodity	Major operation companies and major equity owners	Location of main facilities	Annual capacity
Cement	Chinfong Hai Phong Cement Corp. (Chingfong Group of Taiwan, 70%; Hai Phong Municipal Government, 15.56%; Vietnam National Cement Corp., 14.44%)	Min Duc near Hai Phong City	1,400
Do.	Morning Star Cement Ltd. (Holcim Group of Switzerland, 65%, and Vietnam National Cement Corp.—Ha Tien I, 35%)	Hon Chong, Kien Giang Province	2,400
Do.	Nghi Son Cement Corp. (Taiheiyo Cement Corp., 45.5%; Mitsubishi Materials Corp. of Japan, 19.5%; Vietnam National Cement Corp., 35%)	Nghi Son, Thanh Hoa Province	2,150
Do.	Vietnam National Cement Corp. (100% state-owned)	Bim Son, But Son, Da Nang, Ha Tien I, Ha Tien II, Hai Phong, Hai Van, Hoang Mai, Hoang Thach, and Tam Diep	18,000
Chromite	Thai Nguyen Nonferrous Metal Co. (wholly owned subsidiary of state-owned Vietnam National Minerals Corp.)	Nui Nua, Thanh Hoa Province	200
Coal, anthracite	Vietnam National Coal Corp. (100% state-owned)	Cam Pha, Cao Son, Coc Sau, Vang Danh, Dong Trieu, Ha Lam, Ha Tu, Hong Gai, Khe Cham, Mao Khe, Mong Duong, Cua Ong, Uong Bi in Quang Ninh Province	33,000
Fertilizer:			
Apatite	Vietnam National Chemical Corp. (100% state-owned)	Lao Cai, Lao Cai Province	900
Nitrogen, ammonia	do.	Ha Bac, northern Vietnam Phu My, Ba Ria-Vung Tau Province	375
Superphosphate	do.	Lam Thao, Phu Tho Province	800
Gas, natural, million cubic meters per day	VietSovPetro (a joint venture of Vietnam Oil and Gas Corp. and Zarubeznheft, a Russian oil company), and joint venture of PetroVietnam, BP p.l.c. of the United Kingdom, Oil and Natural Gas Co. of India, and ConocoPhilips Co. of the United States	Offshore Bach Ho Oilfield, Rang Dong Oilfield, and Lan-Tay/Lan-Do Gasfield	18
Iron ore	Thai Nguyen Iron and Steel Corporation (wholly owned subsidiary of Vietnam Steel Corp.)	Trai Cau and Tein Bo in Thai Nguyen Province Thach Khe in Ha Tinh Province; and Quy Xa in Lao Cai Province.	850
Petroleum, crude, thousand 42-gallon barrels per day	VietSovPetro (a joint venture of Vietnam Oil and Gas Corp. and Zarubeznheft, a Russian oil company)	Offshore Bach Ho, Rong, Rang Dong, Ruby, Bunga Kekwa, Dai Hung, and SuTu Trang Oilfields	390
Salt	Vietnam National Salt Corp.	Nam Dinh, Nghe An, and Hai Tin Provinces	14,000
Steel, crude	Vietnam Steel Corp.	Cai Lan, Thai Nguyen Province, and Phu My, Ba Ria-Vung Tau Province	800
Tin:			
Concentrate	Cao Bang Nonferrous Metal Co. and Nghe Tinh Nonferrous Metal Co. (wholly owned subsidiaries of state-owned Vietnam National Minerals Corp.)	Pia Oac, Cao Bang Province; Quy Hop, Nghe An Province; and Tam Dao, Tuyen Quang Province	4
Refined	Thai Nguyen Nonferrous Metal Co.	Thai Nguyen, Bac Thai Province	4
Titanium, ilmenite	Bimal Minerals Co. Ltd. (Malaysia Mining Corp. and Syarikat Pendorong Sdn. Bhd., 60%, and Binh Dinh Minerals Co., 40%)	Cat Khanh, Qui Nhon, and Binh Dinh Provinces	70
Do	Ha Tinh Minerals and Trading Co.	Cam Hoa, Ky Annh-Cam, Xuyen, Ky Khan, and Ky Ninh, Ha Tinh Province	130
Do.	Mineral Development Co. No. 4 and No. 5 (wholly owned subsidiaries of Vietnam National Minerals Corp.)	Vinh City, Nghe An Province; Tuy Hoa, Dong Xuan in Phu Yen Province; and Quang Ngan, Vinh My in Thua Thien-Hu Province	50
Zinc, concentrate	Thai Nguyen Nonferrous Metal Co. (wholly owned subsidiary of state-owned Vietnam National Minerals Corp.)	Cho Dien, Bac Can Province	45

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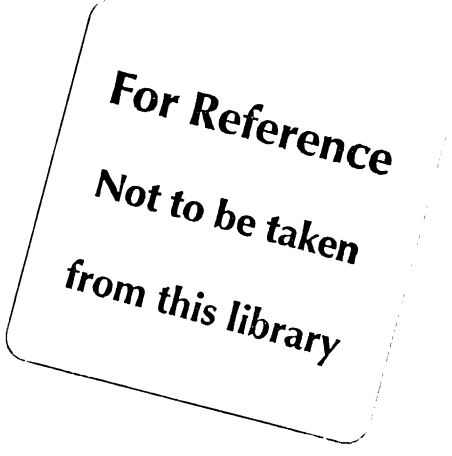

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